THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXII. No. 809.] LONDON, NOVEMBER 12, 1878. [30th Year.] Price 6d.

COOKE BROS.

See Page 722.

26, 27, & 28, FENCHURCH ST.,

LONDON, E.C.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
Several Prize Medals. Established over 20 Years.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*
Supplied, mixed ready for use, or in paste, as desired.
TORBAY PAINT COMPANY.
Proprietors: STEVENS & CO.,
21, GREAT WINCHESTER STREET, LONDON.
Works: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
LAYING MAINS
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL & CO.,
LIMITED,
Established at the commencement of Gas Lighting,
Manufacturers of
TUBES AND FITTINGS.
THREE PRIZE MEDALS,
Paris, 1878.
Head London Office:
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ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
LICENSEES AND MANUFACTURERS OF
HUNTS
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.
Established 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.

J. & H. ROBUS,
BUILDERS AND CONTRACTORS
FOR THE
ERECTION AND REBUILDING OF GAS AND WATER WORKS.
ESTIMATES FREE
FOR MAIN-LAYING AND GENERAL REPAIRS
RETORT-SETTING A SPÉCIALITÉ.
ROBUS'S IMPROVED RETORT-SETTINGS guaranteed to carbonize a large amount of coal with a small per cent. of fuel.
N.B.—All kinds of Fire Goods, &c., kept in stock for immediate delivery. Orders promptly attended to.
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THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
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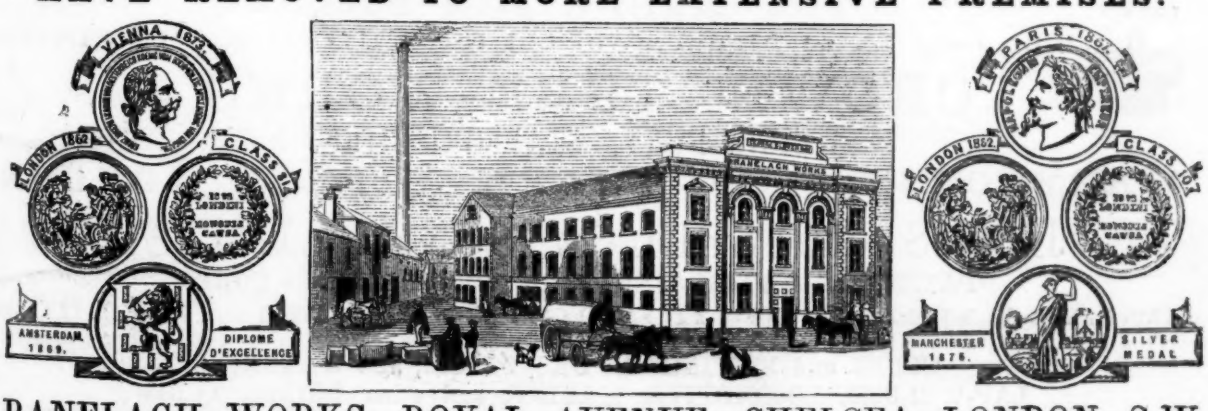
CHANGE OF ADDRESS.
GEORGE GLOVER AND CO.,
DRY GAS-METER MANUFACTURERS,
HAVE REMOVED TO MORE EXTENSIVE PREMISES:



RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

AND

COOMBS WOOD TUBE-WORKS, HALESOWEN,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS,

AND

LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES,

UP TO FOUR FEET IN DIAMETER.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

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JOSEPH AIRD,

WELLINGTON TUBE-WORKS, TIPTON, STAFFORDSHIRE,

MANUFACTURER OF

EVERY DESCRIPTION OF TUBING, GAS, STEAM, HYDRAULIC TUBES AND FITTINGS,
EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS,
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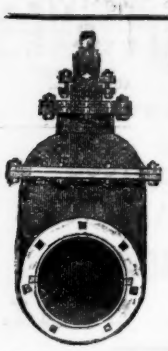
CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
TELEGRAPH TUBES OR POLES, &c., &c.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.

These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

TRADE MARK

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

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WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

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TUBES and FITTINGS for GAS, STEAM, and WATER;
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HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.;
GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

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MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

RICH. H. TAUNTON & HAYWARD,

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WROUGHT-IRON GAS, WATER, & STEAM TUBES & FITTINGS,

STAR TUBE WORKS, HENEAGE STREET, BIRMINGHAM.

HYDRATED PURIFYING MATERIAL.

Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

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SULPHATE AMMONIA.

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Are Buyers of SULPHATE AMMONIA in Large or Small Quantities, or Sell on Commission for Gas Companies and Makers.

PLANT ERECTED ON THE LATEST AND MOST APPROVED PRINCIPLE.

AGENTS to THE GASLIGHT AND COKE COMPANY, LONDON, for the SALE of SULPHATE AMMONIA. Works: BECKTON.

Established

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THE ORIGINAL

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LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

July 2, 1877.

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BY

OXIDE OF IRON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

THE AMERICAN GAS-LIGHT JOURNAL.

A. M. CALLENDER & CO., Proprietors. **G. WARREN DRESSER, Editor.**

Issued Semi-Monthly at No. 42 Pine Street, New York City.

This Journal is especially devoted to Gas Engineering and Manufacture, and is the official organ of the AMERICAN GAS-LIGHT ASSOCIATION, and the NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Subscriptions at $3.50 per annum, post paid, to Great Britain, may be made direct by forwarding Post Office Money Order or Draft to the above address. Rates of advertisement, $2.00 an inch. Special rates for larger spaces.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

THE FARNLEY IRON COMPANY, LIMITED,

FARNLEY, near LEEDS,

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS & FIRE-BRICKS,

Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.

In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.

London Agent for Gas-Retorts: D. W. OGG, 3, Jeffrey's Square, St. Mary's Axe, E.C.

" " Glazed Bricks: A. BARFIELD, 22, Great George Street, Westminster.

LIVESEY FIRE-CLAY WORKS.

NEAR BLACKBURN, LANCASHIRE.

(ESTABLISHED 1835.)

ORLANDO BROTHERS, LIMITED,

MANUFACTURERS OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

THE

STANDARD WASHER AND SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]

Some of the advantages claimed for this Apparatus are as follow:—

The Exposing of a large Amount of Effectually-wetted Surface (which is continually reproduced) to act upon the Gas.

Unerring Regularity in the Distribution of the Liquor.

Saving of Expense in Providing and Exchanging Scrubbing Material—none being required.

Economy of Space, thus enabling the Apparatus to be protected from the Weather.

Economy of First Cost and of Maintenance.

It works without Pressure.

It is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.

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ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

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LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

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GOWTS BRIDGE WORKS,

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LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

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GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

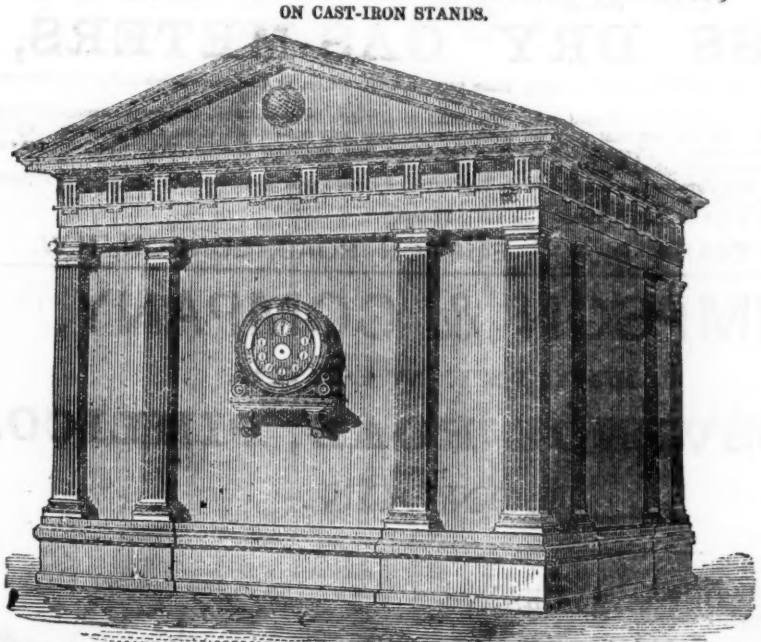
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

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C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

FINSBURY CIRCUS, LONDON.

ESTABLISHED IN 1860.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,

22, HERMES STREET, PENTONVILLE ROAD

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DEMPSTER & SONS'

RENOWNED

WOOD SIEVES,

WITH TAPER BARS,

MADE BY MACHINERY

CAPABLE OF MAKING 10,000 PER WEEKLY.

References to Hundreds of First-Class Engineers.

ROSE MOUNT IRON-WORKS,

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JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

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Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING

MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD,

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THOMAS TURTON AND SONS,

SHEAF AND SPRING WORKS,

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MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNERS

RATCHET BRACES, LIFTING-JACKS,

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The following Medals have been awarded:—

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The only Gold Medal awarded for "Apparatus and Processes for Heating and Lighting" by the Imperial Commissioners

MEDAL FOR PROGRESS, VIENNA, 1873.

The following Medals were also awarded at Paris, 1878:—

GOLD MEDAL for Chandeliers and Gas-Fittings.

GOLD MEDAL (Rappel) for Metallic Bedsteads and Furniture.

GOLD MEDAL (Rappel) for Art Metal Work. BRONZE MEDAL for Tube Metal and Wire.

MANUFACTURERS OF BRASS AND COPPER SHEETS,

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ROLLED METALS, LOCOMOTIVE AND CONDENSER TUBES, CYLINDERS;

Ornamental, Taper, and Cased Tubes; Tin Tubes;

GAS-FITTINGS, CHANDELIERS,

BRACKETS FOR HEATING AND LIGHTING;

METALLIC BEDSTEADS.

Ecclesiastical and Mediæval Metal Workers.

GENERAL BRASSFOUNDERS.

REGISTERED TRADE MARK:

LONDON OFFICES & SHOW-ROOMS: R. W. W. & CO. 141, FLEET STREET, E.C.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

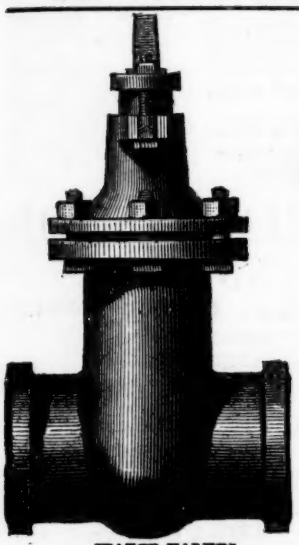
Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.



WATER-VALVES.
All Sizes, Flange and Socket, kept in Stock, tested to 1000 feet head.

SIMPSON & COMPANY,

ENGINE-WORKS,

GROSVENOR ROAD, PIMLICO,

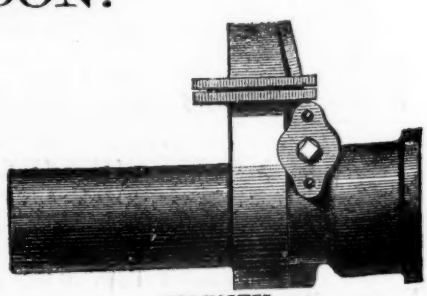
LONDON.

SCREW-COCKS, HYDRANTS,

SLUICES, PENSTOCKS,

And all other Machinery for

WORKS OF WATER SUPPLY, DRAINAGE AND IRRIGATION.



GAS-VALVES.
All Sizes, Flange and Socket, kept in Stock, tested to 100 feet head.

TANGYE BROTHERS AND HOLMAN,

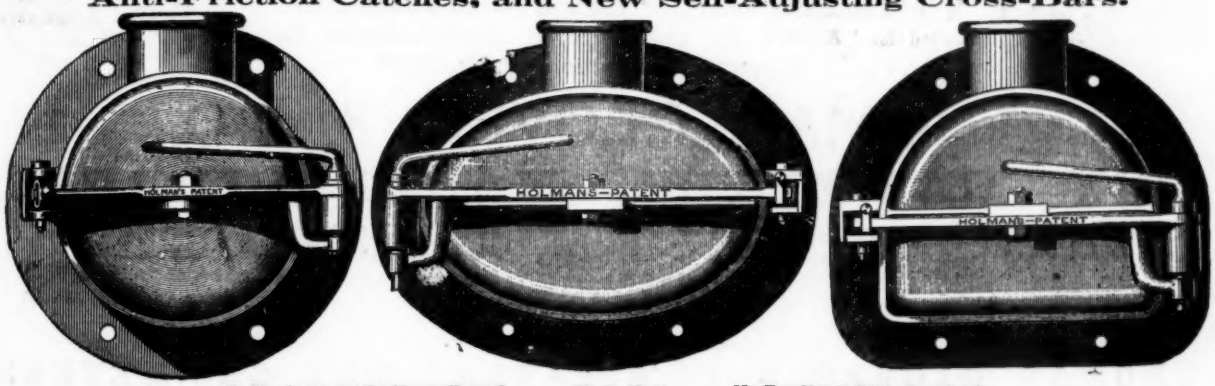
CORNWALL HOUSE, 35, VICTORIA ST., LONDON, E.C.

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
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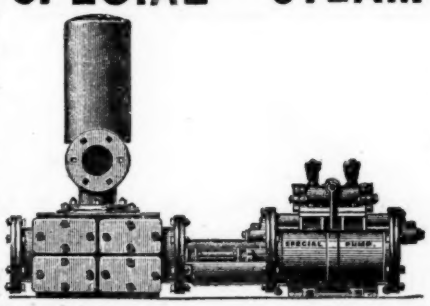

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London, 1851 New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

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PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

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LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

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3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

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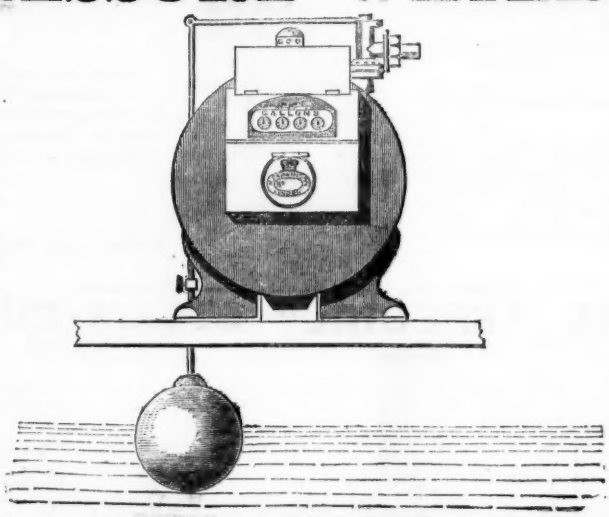
The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



From "The Engineer," April 6, 1877.

"Low-pressure Meters have been found to register with almost perfect accuracy, or, at all events, within 5 per cent. either for or against the consumer, and from the nature of their construction are by no means easily deranged. Still, even the low-pressure meters have their disadvantages, but these are chiefly as respects the question of first cost, seeing that they must have a cistern fixed at a higher level than that at which the supply is needed. All things considered, however, the balance of opinion rules at present in favour of the low-pressure Meter, and they are consequently increasing in favour as time goes on."

These Meters have been manufactured by W. P. & Co for more than 25 years, and are largely used by the following and other Water Companies:—

NOTTINGHAM, DERBY, LEICESTER, SUNDERLAND, GREAT YARMOUTH, SHEFFIELD, NORWICH, LOWESTOFT, COVENTRY, SOUTHEND.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

Until arrangements, consequent upon the recent death of Mr. William B. King, are made, all communications for the Editor, remittances and orders for subscriptions and advertisements, &c., should be addressed to Walter King, 11, Bolt Court, Fleet Street, London, E.C.

G. Gandon; J. Langdon Down.—*Too late for this week.*

G. J. Yeo, Shanghai.—*Your letter has been forwarded to Mr. Golding.*

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 12, 1878.

Circular to Gas Companies.

The Metropolis is being flooded with exhibitions of the electric light. Some of those now *in esse* are in many respects remarkable. That of Messrs. Wells, of Shoreditch, is a beautiful illumination; that of the Stereoscopic Company, in Regent Street, is still more beautiful; but what do they all come to? Simply this, that by the aid of electricity and carbon poles a brilliant light can be generated; but, when this has been done, what has been accomplished in the way of applying electricity to public and domestic illumination? Really nothing. The nearest approach which we have yet seen towards the adaptation of electricity for the latter purpose has been made by Mr. Werdermann, whose system has received the powerful support of Messrs. Berger Spence and Co. At a public exhibition made at the works of the British Telegraph Company, last Wednesday, it was plainly demonstrated by the inventor that an electric current could be subdivided, so that either two or ten lights might be supplied by electricity generated from one small Gramme machine, actuated by a two-horse power engine. Much mystery has been made about the means to be used for the division of an electric current. What apparatus M. Arnaud and Mr. Edison employ we do not yet know; all we can say is, Mr. Werdermann's arrangements are of the simplest character. Given "a cable" carrying an electric current from a small Gramme machine, arranged for "quantity," you have only to connect wires with this cable at intervals, and a certain portion of the electric current is diverted from the cable. Who would have thought that, after all that has been written and spoken about the division of the electric current, it could be effected by simply attaching wires at intervals along a cable, just as service-pipes can be inserted into gas-mains? But this is not the whole of the invention.

The ingenuity displayed in dealing with return currents is undoubtedly the great feature of the discovery. The arrangements for keeping the carbon poles, if not in actual contact, in very close proximity, are of the simplest possible description. The negative pole, which is a flattened hemisphere of carbon, about two inches in diameter, is fixed above, the rounded side being placed downwards. The positive electrode — a bar, or thin cylinder, varying from three to seven millimètres in diameter, according to the light it is intended to produce—is fixed below, in a brass socket which is made to move by means of balance-weights passing over pulleys. This simple arrangement is most effective in keeping the two poles, as we have said, in contact, thus maintaining a very steady light.

It must be admitted that up to a certain point the experiments made on Wednesday afternoon were eminently successful. It was clearly demonstrated that a stream of electricity could be divided so as to furnish a few lights of high illuminating power, or a larger number of smaller lights. We may remark here that the lights did not appear to have the power ascribed to them; the larger lights, said to be equal to three hundred and twenty candles, certainly did not seem to be equal to such number, and the smaller, estimated at forty-candle power, we should have guessed at very much less. But as we understood that the illuminating power had been tested by the selenium photometer, we express no confident opinion.

So much, then, is settled. A two-horse power engine, actuating a Gramme machine, will develop an electric current which may be made to supply two large or ten small lights. We take this as an illustration of the possibility of supplying electricity for the illumination of a shop or a house; but how many people will care to have gas or steam engines in their basements? We are confident no householder will consent to have his domestic quiet disturbed by the noise and racket which must necessarily be produced along with the light.

The cost of the light has not been accurately made out by Mr. Werdermann. All that appears to be known at present is, that the cost of the carbon points for the smaller—said to be forty-candle—lights, is one penny each per hour. Now, five feet of sixteen-candle (generally seventeen) gas can be bought in London for 0·72 of a farthing. Supposing any one wanted a forty-candle light, he has only to burn twelve and a half feet of such gas per hour, which will cost him 1·8 farthings, or a little under a halfpenny. In this calculation it will be seen that nothing is put down for the cost of motive force, which other inventors reckon at a penny per horse power per hour; nothing for the interest on the cost of plant, and nothing for depreciation: it is merely the cost for the carbon poles. Something might be said also of the charge for labour, which would be necessarily entailed by the use of these machines.

A word may be said about the engines which would probably be used for the production of the motive force. They would, no doubt, in numerous instances, be gas-engines; and, supposing an ordinary steam-engine to be employed, gas would probably be used to generate the steam. Looked at from whatever point of view we may choose, we feel satisfied that the electric light bodes no ill to gas.

We must stop here in order to pay a very well-merited compliment to Mr. Werdermann's ingenuity. He has successfully solved the problem of subdividing the electric current. Whatever other inventions may be brought out, it must be conceded that he has been the first in this country to publicly exhibit a divided stream of electricity. It should have been said before, that the lights exhibited were naked—that is, not enclosed in glass shades. To our eyes the effect was not agreeable; the light was extremely fatiguing, and we doubt whether one of the reputed forty-candle lights could long be borne in a good-sized room. We are not alarmists, but cannot help thinking that the continued use of such lights would soon add to the practice of oculists. We call to mind a distant day when we assisted in producing the electric light by the use of a good many—we forget the number—of Wollaston's batteries, and remember that every session our estimable teacher, after exhibiting just such a light as the forty-candle burners, invariably had an attack of inflammation of the eyes. This possible casualty, however, does not detract from the merit of Mr. Werdermann's invention.

The Jablochkoff system is presently to be tried on an extensive scale, under the auspices of the Corporation of the City of London,

in Billingsgate Market, where careful notes will be made of the cost incurred. How a comparison will be made with the cost for gas, we do not know. We may take it for granted that the market will be far better illuminated; but this is only owing to the parsimony of the Markets Committee, who have never allowed sufficient gas to be supplied.

The Rapieff system is having a trial at Woolwich Arsenal, where it is reported to be very successful, and where a more extensive employment of it is projected. The Lontin system continues in favour in some quarters, and probably a more extended use may be made of that light. All this, however, is nothing. The consumption of gas cannot be said to have been at all affected, and we venture to predict that it will not be for many years to come.

It is reported that the invention of Mr. Edison consists in raising a coil of platinum wire to vivid incandescence, by which means, of course, a brilliant light will be produced. Nothing has, as yet, been made public respecting the mode in which he subdivides the current. In the meantime, we notice several additional applications for patents for "Improvements in lighting "by electricity." We shall know all about them in time, but it must be very mortifying to Mr. Edison to see London being covered by electric lights before he has a chance of making any exhibition. He must produce something of superior excellence, or his chances of achieving any success in this country are gone.

The Press and the public in general are, for some reason or other, no friends to Gas Companies, and it is difficult for any one who has a word to say against the electric light to get his opinions inserted in the popular journals. Our friend, Mr. Hartley, who, like ourselves, entertains strong doubts as to whether the electric lights ordinarily exhibited possess the amount of illuminating power ascribed to them, tried to give expression to his views in the daily papers, but without success. Able editors will not be convinced, even by so eminent a photometrist as Mr. Hartley, that an electric light, said by its producers to have the power of 7000 candles, can have one candle power less. We believe Mr. Hartley was perfectly right when he estimated the value of the light he saw at Kennington Oval at little more than a third of its reputed luminosity.

We commend to our readers notice a letter from Mr. William Livesey, which we publish in another column. This gentleman has well studied the bearings of the electric light in their relations to gas, and no one is more competent than he to form an opinion as to what these relations may be in the future.

Metropolitan gas shares have somewhat revived, but we are astonished that the scare is extending to country districts, where it is highly improbable the electric light will ever be seen. At a recent sale of gas shares at York, a considerable depreciation in value was experienced; but we are glad to say that a number were withdrawn in consequence of the low price offered for them. At Rochester, also, a great fall took place in the price of shares, and some good bargains were realized.

An amusing exhibition of the electric light was recently made at Liverpool, which we merely notice to show one of the accidents to which the light is liable. The programme promised that the light should be "continuous," but the exhibitor had not proceeded far with his description when the driving-strap of the engine broke, and St. George's Hall was plunged into darkness. Accidents of this kind will, no doubt, be common enough. It will always be necessary to keep duplicate straps; but, when there is no able mechanic on the premises, who is to repair the damage? The exhibitions which have been made at football matches are hardly worthy of notice; but it may be mentioned that, at nearly all, the electric light has turned out a miserable failure.

The Corporation of Warrington have very wisely resolved on extending their gas-works, and for this purpose have decided to purchase sixteen acres of land in a very eligible situation, and are going to Parliament next session to obtain the necessary powers. An attempt was made by a small minority of the Council to scare the members, by the apparition of the electric light, from adopting the resolution of the Gas Committee; but it was not successful. The Gas Committee had apparently foreseen the opposition likely to be raised, and accordingly proposed to insert a provision in their Bill to enable the Corporation to sell the electric light to the public if it should ever become a useful illuminant.

The citizens of Hereford have, at a public meeting, protested against proceeding with the erection of their new gas-works for the next three months. Some second-hand plant has already been purchased, some new ordered, and all the necessary contracts made and signed. We presume, then, that the Council must proceed with the work, notwithstanding the unanimous vote of an informal town meeting. The bugbear, the electric light, was, of course, the alleged excuse; but we are afraid there is something political behind. At all events, we read that two or three hundred men will be without employment for the three winter months if the Council act on this resolution, and all this, it is said, is done by the Liberals.

Water and Sanitary Notes.

At their last meeting, the Metropolitan Board of Works resolved, *nem. con.*, to report (in detail) the cost, so far as it has been ascertained, of all expenses incurred in connection with the Bills which they promoted in Parliament last session, to authorize the purchase of the Metropolitan Water Companies, and to furnish a new supply. This is a very proper concession to a popular request. It can do no harm to any one, and as the statement must have been given at some time or other, it may as well, as we said, be given at once. Possibly it may turn out that the estimates made of the expenses have been excessive, in which case the public mind will be better satisfied. We feel certain that the Metropolitan Board will not again, for some years to come, meddle with the water question, unless it be with a view to obtain some sort of Regulations Act. Parliament, we are perfectly satisfied, will never sanction the purchase of the undertakings by the Board—at all events, as at present constituted. The future of the Companies may be uncertain, but they have nothing to fear from the Metropolitan Board.

The Joint Drainage Board, for effecting the sewerage of the Lower Thames Valley, have decided on carrying out, with whatever modifications may by-and-by seem necessary, a scheme devised by Lieut.-Col. Haywood. He proposes to collect the sewage of the district at Esher, and then take it to some land between the Mole and the Ember. On that he suggests to utilize part of the sewage by irrigation, and to purify the remainder by intermittent downward filtration. The effluent water is to be sent into the Ember. The merits of the scheme are said to be, first, that it deals with the sewage within the district of the Board, and hence will obviate much opposition; secondly, that it is economical; and thirdly, it is calculated it will prove highly efficient. The Board have therefore decided to give the notices necessary before promoting a Bill in the next session of Parliament. It was highly important that the Board should come to some resolution on the matter, as the time allowed them by the Central Authority to make up their minds, was fast expiring. Naturally some dissatisfaction and jealousy was manifested, the disappointed competitors considering themselves aggrieved.

We shall soon have fuller details of Lieut.-Col. Haywood's plan; at present we can only say that it includes the construction of twenty-two and a half miles of sewers, which may be reduced to seventeen and a half miles, and the purchase of seven hundred acres of land, at an estimated cost of £87,000. Of the seven hundred acres, six hundred acres are to be utilized for irrigation purposes, and the remaining one hundred acres for purification by filtration. We have not the whole estimated cost before us, but it seems the probable outlay for this scheme will be less than that of any other of those selected for consideration by the Committee of the Board.

We are glad to see that no great expectations are entertained of making any profit on the sewage farm; and the Board are not likely to be disappointed. The Reading Town Council did hope to make a profit, but it has not been realized. The crops grown are said, in some cases, to be marvellously good; but the sale of the produce is slow. They have a large quantity of last year's hay in stock, which they will have to sell at a considerable loss. Rye grass does not go off so well as it did, and hence another source of failing revenue. It seems a question whether a portion of the farm should not be let, and to let would be the wisest course the Council could pursue. Very few undertakings flourish in corporate hands, and sewage farms are no exception to the rule.

A special meeting of the Derby Water Company has been held to sanction the raising of further capital for the purpose of paying off a loan which some years ago they obtained from their bankers. It is now no secret that the Derby Corporation have decided on making, if they can, a compulsory purchase of the Company's undertaking, and at the meeting we notice—a report of which we publish in another column—an Alderman, who happens also to be a Shareholder in the Company, opposed the raising of the additional capital, on the ground that it would add to the amount the Corporation would have to pay, if they succeeded in obtaining a compulsory Act, which he felt certain would be the case. The Company, reputedly, pay their bankers interest at the rate of four per cent., but the dividends on capital are paid at the rate of seven per cent., which on £17,000

makes a difference of £510 per annum. There is a curious thing here which we do not understand, and should be glad to have explained. It is this: A shareholder said that interest is paid to the bankers in "half-yearly rests," and thus it amounts to about seven per cent. This is a profitable banking business, in which we confess we should be very glad to share. We hold a very strong opinion that the Derby water undertaking will not pass out of the Company's hands, let the Corporation make what efforts they may. As we said some weeks ago the inhabitants of Derby are perfectly well satisfied with the present supply, which is of excellent quality and liberal in quantity. It is not the case of the Stockton and Middlesbrough Company over again. There is no suspicion of the pollution of Derby water, and the complaisance of the Company has never been called in question; hence, everything that could justify the confiscation of the Company's undertaking is wanting, and we venture to predict that they will emerge from the coming struggle with success and honour.

The Corporation of Barnsley thought of adding largely to their water-works, but seem, on second thoughts, to have come to the conclusion that, if £300,000 were expended in adding to the works, it would be merely for the benefit of the out-townships, and, as regards Barnsley itself, would simply make a large addition to the debt of the town. The out-townships, it seems, under present arrangements, are only entitled to water when the Corporation have it to spare. This is scarcely a reasonable contract, and it ought to be revised. The out-townships are quite incapable of providing water for themselves, and it ought to be made binding on the contracting Corporation to share and share equally. There will be no application by the Corporation of Barnsley to Parliament this session, but one cannot long be deferred, and full consideration should be given to the matter in the course of the next year.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

MR. MALAM ON THE LEAKAGE OF GAS AT HALIFAX.

SIR,—In past times Gas Engineers, I am told, considered that the best way to advance their own interests was to be as exclusive as possible, and, whenever an opportunity served, to blacken and vilify the characters of their professional brethren. Mr. Malam appears to be a relic of those bygone days, and, possibly, sighs for the return of the time when such insinuations might have had the effect of doing some one an injury. As an ancient relic, let us give him a few moments consideration, if it is only for the purpose of learning what it is desirable to avoid.

Mr. Malam has recently thrust himself into a correspondence, the merits of which he is evidently quite unable to comprehend; but he thinks he sees some kind of relevancy betwixt it and a small leakage at Bingley, or concludes that it is a fitting opportunity for again bringing himself into public notoriety. Anyway, the old tactics are resorted to, and he begins by making insinuations against the reputation of some members of his profession, persuading himself, I suppose, by some sublime mode of reasoning, that his own reputation will come out the brighter for it.

In his letter to you of the 12th ult. [see JOURNAL, p. 595], the purport of which it is difficult to find, unless it be self-glorification, he insinuates that Mr. Woodall is guilty of inaccuracy in a report to his Committee, for the purpose of misleading that body. Mr. Woodall promises a reply, and volunteers a statement that he will endeavour to ascertain how Mr. Malam has worked the "rich mine," so that he may compare it with Leeds; and as there has not existed a rich mine at Bingley during Mr. Malam's time (although, according to his first letter, he is in a fair way for making one, for he says that last year was much in excess of the average), he was obliged to apply at Halifax. Mr. Malam then attempts to anticipate Mr. Woodall by volunteering an excuse in the way of an explanation, and again he tries to make himself look white by blackening another person, and this time the soot falls on me. The character of Mr. Woodall, both for accuracy and honesty, is sufficiently well known in the gas world not to require vindication at my hands. I will therefore deal with that part of the correspondence which refers to myself and these works.

Since my appointment at Halifax, Mr. Malam has endeavoured to make my position as uncomfortable as possible; he has attacked me openly through the local press, and covertly through individuals, although I did everything short of perjuring myself to screen him when I came here. Hitherto, the results which have proceeded from my appointment have been quite sufficient to prove the injustice of all his previous charges, and I should have been pleased to content myself with this mode of reply, had it not been for the letter to which you gave publication in your last issue. I am accused of incompetency on account of the smallness of my salary, albeit it is the largest ever paid at Halifax. I would remark here that during the year when Mr. Malam exercised such wonderful skill in manipulating the leakage (1866), he received the enormous salary of £150, with a few other advantages, such as house, coal and gas, and after his vast experience here, £150 per year was a sufficient inducement for him to accept the position at Bingley. Speaking of the leakage, he says he was appointed in August, 1864, so that really his first year was 1865. In his letter he uses this sentence: "But *each successive year* the leakage decreased till, in 1866" (one year later), "it ran as low as 7·34 per cent." Now, just at this time, the year was altered from July to January, to be from January to December, and Mr. Malam, either by accident or design, has dropped six months working completely out of the record—that is, from July 1 to Dec. 31, 1865. When this is put to his year 1866, I find the leakage over the whole period to be 8·99 per cent.—a figure which is a little more in unison with the preceding and succeeding periods. Just about this time, 1865-6, there was a large extension of the borough boundary, which, as a matter of course, necessitated considerable extensions of the mains, so that for a few years following there was probably a larger proportion of new mains and services at work than there will ever be again, or than has ever existed since the Corporation took hold of the concern. He afterwards goes on to say that the leakage became worse, because "each subsequent year three gasholders showed increasing signs of rapid wearing out, and, in consequence, the leakage got gradually up to 11·32 per cent., at which figure I left it in December, 1874." This is the most remarkable statement that has ever come under my notice. Mr. Malam would actually have us believe that 4 per cent. of the whole of the gas made in 1874—*i.e.*, the difference between 7·34 and 11·32—had actually leaked out of the fissures of two gasholders (one having "been completely abolished," and been replaced by a new one many years before, which gave him about 60 per cent. of quite new gasholder room), one of which worked only a portion of that year before it was repaired. The make in 1874 was 246,912,000 cubic feet, 4 per cent. of which is 9,876,480; so to that, in round numbers, 10 million cubic feet of gas escaped from two gasholders, the aggregate capacity of which is below 700,000 feet. They each leaked away as much as they could hold from 14 to 15 times in one year, or at the rate of 27,000 cubic feet per day, right under his nose, and he was impotent to prevent it. There was more gas escaping from those holders than would be delivered by a 3-inch main a distance of 500 yards with the end open, and a pressure of half an inch at the other end. This kind of reasoning may suit Mr. Malam, and possibly the Bingley Commissioners, "but it does not leave the impress of accuracy on men necessarily more acquainted," &c.

My view with regard to leakage is that if I use a coal capable of yielding 11,000 cubic feet in a laboratory test, and I only succeed in selling 8000 feet, the real leakage is the difference. At Cheltenham, where they succeed in selling from 10,000 to 10,300 feet per ton of coal carbonized, it is easy to believe in a small leakage; but at Bingley, where the per centage of leakage is said to be about the same, they only sell 9169 feet per ton (*vide* Analysis, p. 601); while at Halifax, with the large leakage of 10·52 in 1877, we sold 9476 feet per ton; so that the real leakage is considerably less than that at Bingley. During the ten years that Mr. Malam had charge of these works, the average quantity sold per ton of coal carbonized was 8149 cubic feet. I may also mention, with regard to that portion of the leakage which took place betwixt the station-meter and the consumers meters, that, so far as I can learn, he exercised no control over the outside department. I believe he rarely, if ever, interfered. The whole of that department was in the hands of his deputy, who is still in the same position; but Mr. Malam is one of those austere men who have no objection to gathering where they have not strawed.

In conclusion, I will just make one reference to the question of "*extra* labour." When I engaged with the Halifax Corporation, I undertook to devote myself, according to the best of my abilities, entirely to the interests of the Corporation, and I have faithfully endeavoured to do so. I worked as hard, when my salary was little more than half what it is now, as I do to-day; therefore, if I have failed, it is on account of incompetency. But I had rather a thousand times be considered incompetent than that it should be for a moment thought that I could be capable of such dishonesty as to pause and consider, when anything wanted doing, whether I was sufficiently well paid or not to do it.

WM. CARR.

Gas-Works, Halifax, Nov. 8, 1878.

THE ELECTRIC LIGHT.

SIR,—Copies of the enclosed letter were delivered at the offices of four of the leading daily papers on Tuesday evening last, but, quite as I expected, did not obtain insertion in any of them.

F. W. HARTLEY.

55, *Millbank Street, London, S.W., Nov.* 8, 1878.

"To the Editor of the ——

"Sir,—Success is rarely ensured for any project or invention by deliberate misstatement, such as I am sorry to see so frequently put forward in relation to the electric light. The public are constantly being told that the power required to produce the electric light is very small, and that the light produced is powerful almost beyond conception. Such statements are not only untrue, but extremely mischievous, inasmuch as many persons possessing no knowledge of electrical science, and its application to practical purposes, may be probably led to invest money in schemes which, in a commercial sense, are in their nature inherently and utterly rotten. Many schemes for electric lighting are now being brought before the public, but of most of them I have no hesitation in saying that their asserted economic values are based on statements as false as it is possible for unscrupulous ingenuity to invent. I do not mean to impugn the honesty of a large number of those who make such statements; on the contrary, I incline to the belief that they are labouring under an infatuation which prevents them from realizing the truth. They are enthusiasts, and, like too many enthusiasts, succeed not only in doing mischief to interests with which they are not connected, but also to their own—in the case in question by prejudicing the prospects of the schemes which they are putting forward with so much pretension, the impracticability or costliness of which schemes will only perhaps be realized by investors after the loss of many thousands of pounds.

"An example of the length to which electricians are disposed to go in exaggerations and misstatements is to be found in the report contained in this day's issue of the *Daily Telegraph*, relative to the electric lighting at Kennington Oval last evening, on the occasion of the football match. The reporter was, doubtless, furnished with the particulars given by him, and, however desirous to avoid errors, had no alternative but to accept the statements made to him as true. Well, I find it asserted that the *principal* dynamo-electrical machine, with Serrin's

regulator 'gave a power—or rather a light—equal to 7000 candles.' Now I, as an old and practised photometrist, emphatically declare that, in my judgment, the light could not have exceeded 2500 sperm candles light intensity, or something under *one-third* the intensity claimed.

"Again, it is stated that 'the power absorbed was 3·3-horse power.' I might ask, how was the amount of the said 'absorbed' power determined? Certainly there was no effort made, by the use of an indicator, to show it. Then, again, the engine is described as 'small.' What I saw was a 10 to 12 horse engine, running at a pretty high speed, and with 40 lbs. of steam pressure in the boiler. This engine had two men in attendance—possibly one to look after the dynamo-machine, for these things do want looking after pretty carefully. Yet, forsooth, the engine is declared to be worked at '4d. per hour' for fuel, water, and wear and tear, I presume. Than such a statement nothing can be more absurd, and it is high time that the minds of a too credulous public should be disabused.

"The truth is, that while schemers and inventors of a certain kind will 'calculate' with all the readiness of the typical Yankee, they evade the test of the actual determination of the motive power required to produce a certain lighting effect.

"I have looked into the subject of electric lighting, during a long time past, with intense interest, and with a strong desire to see it applied, if it can be so, usefully and economically; but one of the results of my investigations is a conviction (although enormous improvements have been made in dynamo-electric machines, so as to reduce their dimensions and costs) that the cost for motive power, for each unit of light produced, is as great to-day as it was several years since; and, further, that that cost is not likely to be reduced in the future. It seems to me that the balance of forces—motive power *versus* light—has been reached, and if that be so, the electric light, in spite of all 'calculations' to the contrary, will remain an expensive luxury, only fitted for special applications.

"F. W. Hartley, Assoc. Inst. C.E., M.S.E., &c.

"55, *Millbank Street, London, S.W., Nov.* 5, 1878."

Sir,—In anticipation of the gas companies taking some action in this matter in the course of the ensuing session, I think it desirable that there should be some better understanding than there is at present as to what the light can or cannot do, and as to how far it is likely to supersede gas. I will, therefore, with your permission, offer a few observations upon this point. It may be that what I am about to say will not convey any first information to persons engaged in gas operations; but it is to the shareholders in gas companies, and not to their officers, that these observations are specially addressed. Managers of gas companies can readily see that if all that has been said in favour of the electric light were true, there would still not be the slightest chance of its superseding gas in a general way; but gas shareholders, having no knowledge of gas operations themselves, and seeing the grossly exaggerated statements in the papers from time to time as to what the light can do, think their property must very soon be utterly destroyed. It is with the hope of removing some of this groundless alarm that I make these observations. I have no knowledge of the scientific bearings of the question, nor of the cost, and do not, therefore, intend to touch upon these points, but to confine my remarks solely to the practicability of using the electric light, in substitution for gas, for the general purposes to which gas is now applied.

Notwithstanding all that has been both written and said about the electric light, the public have but a very vague idea of what it is, how it is generated, (is this the right word?) or how it should be used. It is very generally supposed that the electric light is produced by the burning of a stream of electricity, in precisely the same way as a stream of gas is burned. But, although the mode of using it has often been explained to the public, they do not retain the idea that it is not the electricity itself that burns, but two pieces of carbon, with which the electricity is brought into contact, and which, as they are burned out, have from time to time to be replaced by others, like candles. It is quite impossible for any one to ascertain, from looking at the light while burning, how it is produced; nevertheless, it is important that there should be no misunderstanding as to these facts.

An electric light equal to 2000 candles, which is about the power generally used in the public experiments, requires a very strong current of electricity, and, to produce this, great mechanical force is wanted; hence it would be necessary for any one who was about to adopt this light, to first of all provide himself with a steam-engine. Some engineers say that, under favourable circumstances, a 4-horse power engine will suffice for two lights of 2000 candles each, and that it is not prudent to have anything less than that for one. Others say less, and others more. In a certain case, where the light has been in use some time, and the cost is but a secondary consideration, it takes all the force of a 14-horse power engine to supply four lights. What the actual relation of power is has probably not yet been settled; it is sufficient for this purpose, however, to know that it exists, and that the greater the power of the light, the greater must be the power of the engine.

The carbons may be used in several ways, but, as the principle is the same in all, the description of one will suffice. In *The Times* and other papers of Monday, the 4th inst., there was a report, which is probably the most circumstantial that has yet appeared, of a new mode of applying these carbons, which is described as follows:—Instead of two carbon rods or pencils, with the points placed one over the other at a certain definite distance apart, as hitherto, there is in this case one carbon-rod about one-eighth of an inch thick, and a carbon disc about 2 inches in diameter, 1 inch thick, and the underside convex. The rod, being fixed in a cap or holder, is held vertically, with the point impinging upon the disc. By this mode the action of the electricity destroys the rod, but not the disc, and to keep the point of the rod always in actual contact with the disc, a pair of fine cords are attached to the cap which holds it, and these are led over a pair of pulleys to balance-weights, which, by pulling the rod up, keep it always in the position required. This apparatus, or whatever else it may be called, is thus essentially a part of the lamp, and whether the light is used on the drawing-room table, in the kitchen, or in the bed-room, there it must always be.

To maintain a steady, uniform light, the revolutions of the engine and the position of the carbons must always be the same. If the motion of the engine is accelerated or otherwise, or the carbons lose their position, the light is instantaneously affected by it, and flickers or goes out altogether.

Any person intending to light his premises by means of electricity, whatever system he were to adopt, would, as I have said, have to provide himself with an engine to generate the electric current, an apparatus to regulate the carbons, and a stock of carbons for general use, taking special care that they were made of the right material. He would then have to make the electricity on his own premises; and as it could not be stored, it would have to be used as made, and the engine lighted up or let down as the lights were required. Every moment that the lights were burning, they would be dependent upon the apparatus, and every proceeding connected with it, being maintained in good working order, as the slightest irregularity would place the whole household in darkness. With such a contingency, who would undertake, or who would be justified in undertaking, the responsibility of lighting, by such means, a church, a theatre, or any other place where people assemble in large numbers? One of the first serious accidents in gas lighting was caused in this way:—Soon after meters were invented, one was fixed up in some very improper place in a chapel, where a person fell over it on entering, and, of course, put out the lights. Upon this there arose a cry of "Fire," a rush was made to the doors, and several persons were trampled to death.

As every one knows, gas, after being purified, is put into gasholders, and stored until required for use, and the holders, when filled, are shut off from the manufacturing apparatus; so that, whatever casualties happen on the works to affect the make, they do not, in the smallest degree, interfere with the supply, that is continued without interruption to the consumer under all circumstances. The holders, when turned off from the works, are turned on to the mains, so that as fast as the gas is drawn from the mains it is supplied again from the holders; the mains are thus always charged, and the consumers can at any time, day or night, take whatever quantity they may require without asking permission from any one, or making any previous arrangement about it; and as there is always a large stock on the works, any extraordinary demand, through a continuance of fogs or otherwise, is always promptly met—the supply being practically inexhaustible—without trouble or inconvenience to the consumer in any shape or way.

The promoters of the electric light ignore these advantages, and talk and act as though they believed the saving of a few shillings would outweigh them all. Our countrymen do not like to throw their money away; but they never object to part with it, and freely too, when they can get value for it; and the saving of time and labour on the part of themselves and assistants is, in their eyes, of very great value. The public would keep to gas, even if the electricity were supplied to them for nothing, if they had to undertake the management of the light themselves.

If the electric light is ever to be a competitor with gas, it must get rid of the steam-engine, dispense with the apparatus for regulating the carbons, do without the carbons, and contrive some means of "bottling up" the electrical current in large quantities, to be used on emergency. The promoters of the electric light have all their thoughts turned in one direction, and that the wrong one—all are seeking to divide the electrical current. But not all the divisions and subdivisions in the world will avail them anything unless they can clear off these cumbrous and impracticable arrangements.

The electric light is a very old acquaintance of gas companies, and has been paying them periodical visits for the last 40 years or so. When it made its first appearance, gas was just beginning to fall in price from the original charge of 15s. per 1000 feet; but even at that price, the electric light was much too costly to supersede it. Gas is now sold for about 3s. 6d. per 1000 feet, while the cost of generating the electric light is as great as, if not greater than, ever. Whether this gives it any better chance of superseding gas than it had before, the promoters must, of course, determine for themselves.

At the present time great importance is attached to the fact of a game of football having been played in the evening, at some place near Sheffield, by the aid of this light. There is, however, nothing remarkable in this. The promoters took care to select the night of the full moon, which, good-naturedly, was shining brilliantly the whole time. When the electric light was first introduced, many years ago, the owners of the Surrey Zoological Gardens, who had shortly before opened them for evening entertainments, exhibited it for many nights in succession to show the visitors out of the gardens after the entertainment was over, and very nicely it answered the purpose, besides being a great attraction in itself; but when the novelty wore off, the light was dropped as too expensive for general use, and so it will be again.

Whenever there is anything like a success in any of the numerous experiments tried with the light, it is always trumpeted forth by all the papers with a unanimity that, to say the least, is very remarkable; but whenever there is a failure, it is kept out of sight, and the public hear nothing about it. While engaged in writing this letter, I had the *Bristol Mercury* of the 26th ult. sent to me, and on an examination of it I discovered the following statement:—

"A complete failure attended a football match which was to have been played at Chorley on Thursday night, by the aid of the electric light. The rain came down in torrents; but about 8000 people gathered on the grounds, and remained for two hours, while efforts were made to light the lamps, but without success. The electricians attributed the failure to the dampness, as the electricity escaped from the wires into the ground."

Since then, there has been an attempt at the same thing in London, and this also, although it took place on a bright moonlight night, proved a failure. There is, however, no need to disparage the light, for it is quite equal to anything that has been said of it.

It is said that there is no danger in using the electric light, and that there is no heat from it; but neither of these statements can be strictly correct. A short time since, while I was watching a trial of the light under the hands of a skilled operator, I observed that a spark flew from his knuckles, and that he suddenly snatched his hand away, as though he had experienced something he did not like. On mentioning this to a gas Director shortly after, he said his own Chairman had, like many others, been over to Paris to ascertain some particulars about the electric light, and, while there, had been told that, very

shortly before, one of the operators had inadvertently brought the current of electricity upon himself, and had the bone of his arm shivered up to the elbow. This is a casualty that it is impossible to get rid of, and whoever has charge of the light—master, man, or maid—will always be liable to it. A moment's inadvertence might at any time injure the operator for life. At the same trial, in the absence of the operator, some irregularity occurred in the apparatus, when the soldering of the three brass rods that supported an opal shade suddenly melted, the rods fell down, and the upper rim of the opal shade falling against the upright bar of the apparatus, the shade itself began melting, and would have been quietly burnt through from top to bottom, had not the operator returned and removed it. It may be that the heat from this light, supposing it to be equal to 2000 candles, is very much less than the heat from a gaslight of the same power; nevertheless, it must be very great in itself. This trial was made in a room 100 feet long, 44 feet wide, and 30 feet high. The light, which was said to be equal to 2000 candles, was at first placed at one end of the room, about 6 feet from the floor; part of the time it was used with an opal shade, and part without. Close to the light, there was a considerable difference between the shade being on and off; but at the far end of the room this difference was scarcely perceptible, and at that distance it was just possible to read and write by the light, but not comfortably. It was then suggested that the light should be placed in the centre of the room, and raised somewhat higher. This suggestion was acted upon, and the light raised to about 10 feet from the floor. In this position the opal shade was not used, but a copper silvered reflector was placed underneath the light, so as to exclude it from the sight of all persons below. The light was thus, in the first instance, thrown, by the reflector, upon the ceiling and the upper part of the walls, and from thence deflected, as it were, on to the tables below. The walls being white as well as the ceiling, this had a very good effect, and produced a clear bright light all over the room, and had the room been 20 feet longer the light would probably have been equally good to that extent—that is, a radius of about 60 or 70 feet, or say 25 yards. The room in which the trial was made is ordinarily lighted with gas by four sun-lights, each light burning 7 rings, and each ring 9 small jets, making in the whole 252 jets, each of which would burn from 2½ to 3 feet per hour, but say 3 feet, which would make their united consumption 756 feet per hour, and the electric light was quite equal to this. A sun-light, however, is not by any means an economical mode of using gas, although it has its advantages; and where many persons congregate in one room, some such arrangement of light is almost obligatory. But eight burners, of Sugg's "London" standard, placed on the tables on each side of the room, and which at the ordinary rate of 5 feet per hour would have only consumed about 80 feet of gas, would have given light enough for all ordinary purposes; and 12 on each side, which would have only consumed 120 feet, would have given a much better light than either the sun burners or the electric light.

Gas, in a general way, is described as of so many candles illuminating power, and the average quality throughout England is, perhaps, 14 candles. But the public do not fully understand the meaning of this; they think that 14 candles is a fixed and definite quality, and not merely a relative one. When, therefore, they hear of an electric light being equal to 2000 candles, they think it is hopeless to expect that gas can ever be brought up to this high standard, and, consequently, that it must be superseded. But something more than a difference in the illuminating power is required for this. Few persons, besides those engaged in gas matters, understand the bearing of this question of illuminating power. The public, although the matter is so often before them, do not bear in mind that, in speaking of gas as being equal to 15 or 16 candles, it merely means that that particular quality of gas is equal to so many candles when used in a certain way, and under certain conditions; the burner and rate of consumption being strictly defined. They do not seem to know that the same gas, if used with another burner, larger or smaller, and with a greater or less consumption, will, under the same testing apparatus, show perhaps as little as 8 or 10, or as much as 20 or more candles.

A short time since, I was shown by Mr. Sugg a burner that was equal to 50 candles, and yet it was but very little larger than the "London" standard; and doubtless, if it were desirable, he could easily make a burner that would be equal to 2000 candles; but it would use a great quantity of gas, and make a large body of light.

The size of the electric light, whether it represents 2000 candles or any less or greater number, is always the same, or apparently, as the increase of illuminating power with electricity is caused by an increase in the intensity, and not in the size of the light. On this account—that is, the greater body of light—gas has, and always must have, where large lights are required, a considerable advantage over electricity. Of two lights, each representing 200 candles, one gas and the other electricity, the former, because of its larger volume, would show a very much greater distance than the latter. The electric light is said to be very soon lost in a fog.

If the system of lighting large rooms or public places with one very large burner is found preferable (and it may be so) to the present system of having a number of, comparatively speaking, small ones, the large burners can be supplied by gas, and adapted to the size of the room or space, more economically, cleanly, conveniently, and better in every other way, than electricity.

It is well known that many things may be used to supplement, and to a very considerable extent, the illuminating power of gas. It is possible, therefore, with gas, to give both the large volume of light and the increased brilliancy together; but to do this the purse-strings might have to be loosened a little.

On the re-introduction of this light on the present occasion, it seems to have been recognized from the first that if the consumer was required to have in his own house a steam-engine to generate the electricity, a machine on his drawing-room table, or wherever else the light was used, to regulate the carbons, and to purchase those carbons himself, at his own risk, it would be useless to try and persuade any one to adopt such a light in lieu of gas, with which there is neither steam-engine, apparatus, carbons, time, nor trouble of any sort required, and accordingly, for a long time after its re-introduction, nothing was attempted in that direction. But a report having been circulated that means had just been discovered in America, and communicated by telegram to this country, of dividing the electric current, whereby it might be conveyed by wires, in tubes under the streets, to the consumers premises, in the same way as the ordinary telegraphic messages, and the leading papers having all taken it up with a somewhat remarkable unanimity, the shareholders became alarmed, and the present depreciation of gas property is the consequence. It does not, however, appear that there was ever any just cause for this alarm, or that any one ever seriously proposed to light a town in this way. Nevertheless, the report has had its effect, and those who originated it have doubtless found their advantage, in some shape or other, in doing so. The public have been entertained, for several months, with experiments to show the effect of the light, and the various ways of using it, and they are now getting weary of them. What they now want to know is, Can it be carried out, as a commercial undertaking, with any reasonable prospect of success, or not? It is remarkable that not one of the promoters has ever put forward any scheme for using it in substitution for gas, or attempted to show how it would be possible so to do, and all such information as would enable the public to form an opinion of their own upon this point has always been, and still is, withheld. The light has been exhibited for a time in one place after another, to attract attention, and then withdrawn; but nowhere has it been "domiciled," and the public think that, in a large place like London, many persons might have been found charitable enough to have given it a home, had it been deserving of one. But, in truth, it has been hawked about so long, that its character has got "blown upon," and it is now known to be what our worthy Scotch friends would call a hopeless "Ne'er-do-weel," that will "gang its ain gait," doing those things which it ought not to do, and leaving undone those things which it ought to do, in spite of all the good advice of its numerous friends and supporters; well born, highly educated, brought out under the most favourable auspices, and introduced to the best society, surrounded by staunch friends, brilliant and fascinating in its ways, but with such expensive and, it must be admitted, irregular habits, that no one will have anything to do with it.

The exigencies of gas lighting may be described as follows, viz.:—One house may require 30 feet per hour, the next 1000, the next 20, the next 500, the next 10, and so on. One house may use the gas in the front shop only, another in the back premises for the workmen, another in the sitting-rooms, another in all parts of the house, and so on. One house may require the gas in the evening only, when it is dark; another all day, for business purposes; and another all night, and so on. The mains, therefore, must always be charged, day and night, and be open to the gasholders, so as to allow the consumers to draw any quantity they require, as and when they require it, without consulting any one, or making any previous arrangement about it; the gas supply being "a constant supply" in all its integrity, which means "any quantity you want at any time you want it." When the promoters of the electric light can prove to the satisfaction of the public that they are prepared to supply their light with all these conveniences, or something nearly approaching them, they may stand some chance of getting the lighting out of the hands of the gas companies into their own; but until then, gas companies have nothing to fear from the electric light.

Mr. Werdermann's discovery, referred to before as having been reported in *The Times* and other papers on Monday, the 4th inst., is described as follows:—A conducting cable is laid on from the machine to the row of lamps, and from it ten wires were led up, one to each lamp, resembling in its appearance a gas-main with its supply-pipes. The current produced by the machine is led along the main cable, and through the supply branches to the lamps, passing through the positive carbons in each, and then through the disc, or negative carbon, and so away, by a return cable, back to the machine. The lamps used, being the first made by Mr. Werdermann, were more or less experimental; they, however, illustrated the principle exceedingly well, giving a steady though small light, of very good colour and moderate intensity. The divisibility of the current was clearly demonstrated, as was the power to extinguish and re-light one or any number of the lamps in the series without affecting the remainder, except to increase their intensity. Mr. Werdermann added: "The proportion of horse power absorbed by each light would be less and less as the number of lights was greater. The greater the number of lights, the greater would be the quantity of current required. The longer the distance traversed by the current, the larger must be the electro-motive power."

This discovery proves conclusively, although it was well-known before, that a strong electric current can be divided into a number of smaller currents; but we apprehend that the discovery consists in the new mode of using the carbons, which certainly appears to be a great improvement on anything hitherto proposed. It does not, however, prove that the electric light can be applied to the ordinary purposes of gas lighting; on the contrary, like all other exhibitions of the same character, it does more to prove that the electric light is not applicable to the ordinary purposes of gas lighting than otherwise.

The report in *The Times* says, with regard to the cost of producing the light, and the photometric value of it: "We can say nothing, inasmuch as the machine was driven from an engine of far higher power than it would of itself require, and there were no means of ascertaining the value of the light photometrically."

In these public experiments there is almost always some apology given for something not having been done, whereby something else might have been explained; and it is always the points upon which the public are most desirous of getting information, and upon which alone they can form an independent opinion, that are kept back.

The experiments and reports are all one-sided; that which is most advantageous to the object in view is brought prominently forward, and everything else kept out of sight.

The chief points upon which the public most desire information may be described as follows, viz.:—

What proportion of steam power is required to produce a current of electricity of a given strength—say for a light equal to those generally used for public exhibitions, which are said to represent 2000 candles?

Does the current lose its force, as gas loses its pressure, by distance; and, if so, at what distance from the engine can it be used without any serious depreciation?

Does the current lose its force by being divided; and, if so, to what extent? In the report of Mr. Werdermann's experiments the power of the initial or main current is not given, but it is stated that the main current was at first divided into two lights, which were equal to 360 candles each, or 720 the two, and then into 10 lights of 40 candles, making 400 in all. Does this represent the actual and unavoidable loss on division, or is it merely accidental?

When the main current is divided into a number of smaller currents, is it necessary that the wires for the smaller currents should be of the same length and strength, and for each light to be at the same distance from the main current? It is the opinion of some scientific men that this is so, and the report of the proceedings in Mr. Werdermann's experiments leads to the belief that it was so in his case.

Can the main current be so divided as to give a light equal to, say, 40 candles in one house, 300 in the next, 1000 in the next, 500 in the next, and so on? If the main current could be so divided, would it be possible for each consumer to light up or put out one or all of his lights without prejudice to his neighbours? and could he also turn them *up* or *down* as well as *on* and *off*? On this point, the report of Mr. Werdermann's proceedings says: "It is that gentleman's intention to introduce a supplementary wire equal to the resistance of any of the lights on being turned off, to prevent its affecting any of the other lights"—an admission, in fact, that the lights could not be turned down, but would have to be used with the full force of the current, subject to its being decreased as other lights were put on, and increased when they were turned out.

Assuming that ten small currents were "laid on" to ten separate houses, would not the force of the current to each house be dependent upon the number of other houses and the lights burning therein at the same time? If one were burning by itself, would it not have the whole force of the main current until some of the other houses were lighted up and took part of it away? Would either of these ten consumers be able to further divide the current "laid on" to his premises if he wanted more lights, or would he be obliged to have another current laid on?

Assuming that a main current were divided into as many small currents as it well could be—say ten, for illustration—and one, two, or three adjoining houses wanted to have the light. What then? Would it not be necessary to put up another engine, and, perhaps, purchase other premises, to keep within the travelling distance of the main current? When the motion of an engine is accelerated, and the electric current is increased suddenly, by that or any other means, do not the carbons, one and all, throw down sparks, and occasionally burning flakes of the carbon, on to the table or floor, as the case may be?

If all these points were gone thoroughly into, and fully explained to the public, there is not the slightest doubt but that they would, one and all, be decided against the light, and prove beyond dispute that it cannot be applied to the ordinary purposes of gas lighting, and that it would cost very much more, even if it could.

As some illustration of the cost, it may be stated that the consumption of gas is probably four times as much in the depth of winter as it is in the height of summer; but the engine power would have to be proportioned to the winter consumption; and to allow for casualties and repairs, and guard against any district being left in darkness, it would be necessary to always have two engines, each equal to furnishing the winter consumption. In many large districts there are perhaps only one or two consumers who use gas in the daytime, and about the same number who use it all night; but so long as there was one light burning, it would be necessary to keep up the engine, and this expense would be very nearly the same, whether there was only one light burning or the whole force.

The mode of estimating the cost is, so far as can be judged from the public statements, as delusive as everything else connected with the light. For instance, a railway train with 400 tons of coal ready for starting might be brought to town at an actual outlay of about £2; that is, the drivers, stokers, and guards wages and the coals being about 1½d. per ton; but who would say that this was a fair way of estimating the cost of bringing coals to London? Nevertheless, this is the way in which the promoters calculate their cost; but when they make a comparison between the cost of an electric light and gas, they put the cost of the latter at the price at which it is sold, not that at which it is made.

If all the difficulties about the supply were satisfactorily adjusted, there would still be another, and that by no means a trifling one, and that is, how to make a charge for the light. Unless our friends on the other side of the water have discovered a means of supplying electricity by meter, this would not be an easy matter to settle equitably.

I now come to the consideration of what steps, if any, the companies should take in this matter; but, before considering this, we ought to get a clear understanding of what the position really is.

The electric light has been known in this country for 40 years or more, and the use of carbons in connection with it for probably the same time; there cannot, therefore, be any patent right for the exclusive use of either one or the other: consequently every individual in the community has a right to use them both for these purposes, if he thinks fit. Under these circumstances, Parliament itself, constitutionally speaking, has no power to grant an exclusive right to any one, as, by so doing, it would deprive the whole community of an existing right. It would, therefore, be utterly futile to expect that any exclusive right to its use would ever be granted. There may, however, be at the present time, or may arise hereafter, some patent right as to the using of the carbons of a particular form, or for making them of some other material, or substituting something else for them; and the beneficial use of the light might be dependent on these. If, therefore, Parliament gave the exclusive power, the companies might not be able to exercise it.

The companies at present have the power of opening the streets for supplying gas, but nothing else. If, therefore, it were possible to supply electricity through tubes in the streets, the companies might reasonably say, As we have already the power of opening the streets, it will be as much to the advantage of the public as ourselves for the power to be continued in our hands, instead of being given to another company.

If we dismiss from our minds all thoughts of conveying through the streets currents of electricity for lighting purposes, as we must, and assume that people would use it in their own houses, what could the companies ask for? They could not undertake to supply electricity, as that is beyond the power of any one. They could only supply the engines and apparatus; or, in other words, turn manufacturers.

Under existing regulations, the companies are only authorized to supply gas; if, therefore, electricity, or anything else, were discovered to supersede gas, the companies would not be able to supply it themselves, whatever it might be, but would have to sit still, with their hands tied, while their property was being destroyed. This would manifestly be a great injustice, which, it may be safely inferred, no Government would desire to preserve. It may, therefore, be desirable, apart from all consideration as to whether the electric light can, under any of the present proposals, be adopted as a substitute for gas or not, to get this prohibition removed before any real necessity for its being so removed arises.

Any company intending to apply to Parliament in the next session for further powers, might reasonably insert some provision for removing this disability; but for any company to make special application for such a purpose would, I think, be throwing money away, as, if it is dealt with at all, it must be by a public Bill. The companies need not be under any special anxiety about it. The local authorities are in the same position. It is true they can light the public lamps with anything they please, but they can only supply private consumers with gas. It is probable that they will be the first to move in it.

The Metropolitan Board of Works have undertaken to try the electric light on the Embankment for three months, the Board paying one portion of the expense, the promoters—the Compagnie Générale d'Electricité—paying the other, and when that is accomplished it may be possible to get some approximate idea of the cost, which at present it is not.

The electric light, such as those about to be tried on the Embankment, which are said to be equal to 2000 candles, gives an intensely brilliant light within a certain radius; but at a hundred yards distance it is not so good as an ordinary gas-lamp. In the best-lighted localities of London the lamps are placed at about 50 yards apart; but in others they vary from 50 to 100 yards, and even more. An electric light placed in a large open space, where it could be seen in all directions, might supersede five or six ordinary gas-lamps; but in a road or street, where it could only be seen in one direction, it would not supersede, even in the best-lighted places, more than three or four; and, taking into account the irregularities of our streets—the London streets not being remarkable for straight lines—the average probably would not be more than two; but the lighting will never be improved by having the lamps wider apart.

That many parts of London are badly lighted, no one can deny; but this arises from the simple fact that the lighting is controlled by the various local boards. The companies supply the gas, and the local boards determine how many lamps shall be used, and in what positions they shall be placed. How the lamps got tumbled into their present places at first, it would be futile now to inquire; but in many localities they certainly do appear to have been put up very capriciously. Not the slightest notice ever seems to have been taken of the width of the road. This, however, was all done before local boards were created. The local boards of the present day put their faith in burners consuming 5 cubic feet per hour, and, whether the lamps are 50 or 100 yards apart, or the road 30 or 50 feet wide, they expect to get the same amount of light, simply because they have the same description of burner. When people see the streets badly lighted, they attribute it to the gas companies; whereas the latter have no voice in the matter.

The great need in London, at the present time, is some controlling power to insist on the lamps in all the leading thoroughfares being placed at certain distances apart, having regard to the width of the roadway, and using 5-feet burners in some places, 7-feet in others, and 10-feet in others, if need be. If this were done, no one would wish to have the electric light.

W. LIVESEY, Secretary.

Gas and Water Companies Association, 5, Victoria Street, Westminster, Nov. 9, 1878.

GAS SHARES.

Pity the poor deluded,
On share-selling madly bent;
Laugh at the dupes denuded
Of interest 10 per cent.

Envy the fortunate buyers,
Free from panic and fright;
Honour the bold defiers
Of Blinding Electric Light.

P. A.

THE BIRMINGHAM GAS ARBITRATION.—The *Birmingham Daily Post* of the 4th inst. says: "The award in this matter, which was made some weeks ago, has just been taken up by the Corporation and the West Bromwich Commissioners. The amount awarded is £70,750. This sum is much less than we expected, but it does not afford any particular subject of congratulation to the West Bromwich authorities. If they had accepted the offer made to them when the Bill of the Corporation was before the Houses of Parliament, they might have obtained the undertaking for little more than they will now have to pay, and they would have been spared all costs in the matter, as well as the loss of profit up to the time of the completion of the purchase, which is two years hence."

SHOREHAM WATER-WORKS COMPANY.—The half-yearly meeting of this Company was held on Saturday, the 26th ult.—Dr. Fuller in the chair. The Secretary (Mr. T. Hardy) read the notice convening the meeting, and also the minutes of the previous meeting. The following was the half-yearly report of the Directors:—"In presenting their 17th half-yearly report, the Directors have to congratulate the Shareholders on the continued prosperity of the Company. By reference to the statement of accounts, it will be seen that there is a balance of £305 8s. 3d. available for dividend. The Directors recommend that a dividend of 3½ per cent. (free of income-tax) be declared, £40 carried to the reserve-fund, and the balance carried forward to the next account. The Directors are also happy to state that additional services have been laid during the half year, producing an annual rental to the Company of about £94. The Directors have not yet completed any arrangement with the owners of the Aldrington Estate, but are still in negotiation with them." On the motion of the Chairman, seconded by Mr. Lightfoot, the report and accounts were adopted. The dividend of 3½ per cent., free of income-tax, was declared, and a sum of £40 placed to the reserve-fund. A vote of thanks to the Chairman concluded the proceedings.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

MONDAY, Nov. 4.

(*Before Vice-Chancellor* MALINS.)

In re THE HERNE BAY WATER-WORKS COMPANY.

This was a petition presented by Messrs. Ripley and Haigh, preference debenture-holders, for the purpose of obtaining a compulsory winding-up order. The previous proceedings in the case have been reported in the JOURNAL. (See *ante*, page 201.)

Mr. GLASSE, Q.C. (with him Mr. DRUCE), said that when the matter was previously before the Court, it was asked that it should stand over until to-day, because it was represented that there was a probability of paying the petitioners debt. He was instructed that the debt had not been paid, and no offer had been made.

The VICE-CHANCELLOR said when the petition was before him last, Mr. Batten, the Solicitor to the Company, stated that there was a reasonable prospect of the debt being paid. Why had it not been paid?

Mr. GLASSE said it had not been paid because the Company could not pay it. The petitioners were creditors for £1745; they advanced the whole money the Company had power to raise by debenture.

Mr. HIGGINS, Q.C., said Mr. Batten was still confident that the Company would be able to pay the petitioners. He had obtained the assent of every creditor, except one for £471 17s., to take shares in the Company in lieu of money. In the event of their doing this, there would no difficulty in paying the debenture-holders, who had a suit of their own before the Master of the Rolls. As soon as the assent of that one creditor was obtained, the money would be found. The action of the debenture-holders, the petitioners, had paralyzed the concern up to the present time. There was an affidavit of Mr. Taylor, a Civil Engineer, who said that there had been latterly a very considerable increase in the building of houses in Herne Bay, and that the Company's increased rental therefrom could not be less than £65 a year, whilst the outgoings would scarcely be affected; and there was every prospect of the Company, at no distant time, being in a position to pay a dividend to the Shareholders.

Mr. GLASSE pointed out that Mr. Taylor, in his affidavit, said no doubt the annual interest on the debentures would be paid, but the petitioners wanted not only the interest, but their principal. For six years they had been struggling to get paid, and had not received a farthing. They could not get an Act of Parliament without a winding-up order. The receiver said the expenses were more than he received. The capital of the Company was originally to be £5000, in 500 shares of £10 each, with power to borrow to the extent of £1200. By the Act it was provided that mortgagees of the Company might enforce payment of the principal and interest due on their mortgages by the appointment of a receiver; and in order to authorize the appointment of a receiver, the amount owing to the mortgagees must not be less than £500 in the whole. Then it was provided that all moneys to be borrowed on mortgage under the Act, and the interest for the time being, should have priority against all the property, from time to time, of the Company. Shortly after the passing of the Act, the whole of the capital was issued by the Company, who constructed the water-works, and commenced the business of supplying water within the district. The business, however, had been carried on without success; the Company borrowed the whole sum they were entitled to borrow—namely, £1200; and thereupon a mortgage was given. Then they obtained a Provisional Order from the Board of Trade, authorizing them to raise a further sum of £3000 by the issue of new shares, with a proviso also that they might raise money by way of mortgage. But it was provided that the mortgage already authorized should have priority over any mortgage or debenture stock issued under that Order. The Order was not acted on, and nothing was done upon it. Failing to get anything, they made default in payment of the interest on March 18, 1872; and on May 7, 1872, the bill was filed praying for a receiver. On the 20th of July an order was made appointing Mr. Turner the receiver. On the 15th a decree was made, directing an account to be taken of what was due to the petitioners for principal, interest, and costs. The receiver passed his accounts on June 16, 1875, and from those accounts it appeared that there was no fund in hand, belonging to the Company, out of which the receiver could discharge the principal, interest, and costs due to the petitioners; but that, on the contrary, there was a debt due to the receiver on account of money paid by him.

The VICE-CHANCELLOR asked whether the Company were supplying the own of Herne Bay with water.

Mr. HIGGINS replied in the affirmative.

The VICE-CHANCELLOR said then the Company must have water-rents.

Mr. HIGGINS: They have, my lord.

Mr. GLASSE: The Local Board have made complaint of the water.

The VICE-CHANCELLOR: If an order is made to wind up, you will go to Parliament?

Mr. GLASSE said they would, and there were purchasers ready to pay £1900, and take the concern. In chambers, the moment the petitioners got an Act of Parliament, there would be an order for sale, and if the order for sale took effect, and £1900 was produced, there would be enough to pay the petitioners their debt. The people who bought would carry on the Company effectually. It might be a very good speculation, for aught he knew. He then read an affidavit of the petitioners, which stated that the Company were in a hopeless state of insolvency, and that the purchasers were willing to pay the expense of an application to Parliament to sanction the proposed sale, if it were approved by the Court. The affidavit of Mr. Turner, the receiver, stated that he had paid more moneys than he had received on account of the Company, as shown by the accounts passed in June, 1875, and that he had not passed his accounts since, because there were no funds to pay the expense of doing so. The income of the Company was wholly insufficient to continue the works, and there was no money to meet the necessary outlay for the increase of the works, which increase was necessary. The affidavit of Mr. Batten, the Solicitor of the Company, stated that he was a creditor for law costs to the amount of £1100, and that a large sum was due to Messrs. Simpson and Co., who supplied the pumping-engines. He believed that the Company could be made a paying concern by the outlay of less than £1000, and that money could be raised upon condition that it should rank *pari passu* with the existing debenture debt.

The VICE-CHANCELLOR said it appeared to him that the only rational course was for the people who thought well of the concern to pay off the petitioners.

Mr. GLASSE, to prove that the Court had power to make the order asked for, referred to the Exmouth Dock case, the Bradford case, and the Wey and Arun case, but said the petitioners had no desire to wreck the Company. All they wanted was to be paid, and if there was any hope of getting the money they would agree to postpone drawing up the order for a reasonable time. Under the circumstances, he contended he was entitled to the order asked for *ex debito justitiæ*.

Mr. HIGGINS, Q.C. (Mr. MILLAR with him), for the Company, said the first question was one of law, and as matter of law he contended that the Court could not make an order to wind up upon the present petition, because the petitioners were not petitioners within the intent and meaning of the Act of Parliament. If his lordship thought he had jurisdiction, then he said the case was not one in which an order ought to be made, having regard to all the facts and circumstances.

Mr. GLASSE: Is it open to the respondents, after the case has stood over from August upon the statement that the money would be paid, to say now that the petitioners are not the proper persons to petition?

The VICE-CHANCELLOR said the representation made was that they had a well-founded expectation of obtaining money to pay off the petitioners, but it appeared they had failed. The consequence of that was the petition was simply postponed until the present time.

Mr. HIGGINS said the petitioners had not had a statutory receiver appointed. He contended, with confidence, that the Court could not make the order.

The VICE-CHANCELLOR: How do you say the receiver is to be appointed?

Mr. HIGGINS: By application to two justices. He did not say the Court had no jurisdiction, under section 199 of the Companies Act, to make an order to wind up a water-works company, although incorporated by Act of Parliament. There might be circumstances in which the Court would make an order to wind up an incorporated water-works company, although, after the experience the Court had had, it would only adopt that course where it was for the benefit of the public and all parties concerned. He did say that the Court could not make an order to wind up the Company merely upon the petition of debenture-holders against the wishes of the general body of creditors. What was the contract which the debenture-holders made with the Company? They made a contract, upon the footing of the Act of Parliament, that the works were for the public benefit, and that the Company were to have a certain amount of capital.

The VICE-CHANCELLOR inquired what was to be done if there were water-works established, and the people would not pay for the water. Were the debenture-holders, who found the money to construct the works, to remain for ever unpaid?

Mr. HIGGINS contended that the point was concluded by the case of *Gardner v. The London, Chatham, and Dover Railway Company*. The debentures were issued by virtue of an Act of Parliament, by which the undertaking and all the works belonging to the Company, and all the future calls on the Shareholders, and all and singular the tolls and so on, were made liable. It was a mortgage of the tolls and future calls by virtue of the powers contained in the Act of Parliament. The Company admitted they could not foreclose, and that was because the Act of Parliament had not allowed them. Therefore, he said the Court could not do more for them than Parliament had done.

The VICE-CHANCELLOR said that £72 a year was wanted to pay the interest. Suppose the Company only produced £50, the petitioners would take the whole of that. He understood Mr. Glasse to contend that a creditor who was not paid was entitled to break up the concern.

Mr. HIGGINS said as debenture-holders they could go to Parliament and say they had been working for years, and Parliament must give them some extra powers. The petitioners said if they succeeded upon the petition they could go to Parliament. They could do it better without; at all events, they would be in just as good a position without a winding-up order as with one.

Mr. GLASSE said they had no power to go to Parliament under the Standing Orders.

Mr. HIGGINS said they could, but if not, so much the worse for them, because that was their position, and the Court had no power to alter it.

The VICE-CHANCELLOR inquired whether the petitioners were the plaintiffs in the suit in which the receiver was appointed.

Mr. HIGGINS: Yes, my lord.

The VICE-CHANCELLOR: You say they might have gone to two Justices instead of coming to the Court?

Mr. HIGGINS: Yes; but nothing turned upon that, except possibly that the receiver appointed by the Court of Chancery had not the same powers of enforcing payment of tolls as the statutory receiver would have. But if the Court had jurisdiction, it was not a case in which an order ought to be made; because the debenture-holders in 1872 instituted their suit in the Rolls Court, and had a receiver appointed, which was the cause of the real misfortunes of the Company.

The VICE-CHANCELLOR said he could not help thinking it would have been better to take the petition where the suit was.

Mr. HIGGINS said he was told that the Company had been unable to get at their own books.

The VICE-CHANCELLOR: Mr. Glasse will undertake that you shall have free access to the books, if that will enable you to get the money.

Mr. GLASSE: Certainly.

Mr. HIGGINS read the affidavit of Mr. John Taylor, Civil Engineer, of Great George Street, which stated that he was Chairman of the Company, and also an unsecured creditor. He was well acquainted with the affairs of the Company, and it was a well-known fact that small Companies for the supply of water were not very successful in their early years, but it was only necessary to give time to make them paying concerns. The income of the Company was steadily increasing, although the supply of water was imperfect. He had ascertained that the want of a proper supply of water arose from the bore-hole of the well being choked, so that the supply did not come from the chalk. He had been in negotiation with a responsible contractor, who had advised that a new bore-hole should be sunk, at a cost of £500, and by an expenditure of £1000 the Company would be able to pay all their debts and a dividend to the Shareholders. There was a regular increase of rental year by year.

The VICE-CHANCELLOR said according to Mr. Taylor's affidavit an expenditure of something under £1000 would make the Company successful. He did not think it was to the interest of anybody to wind it up.

Mr. HIGGINS said there were no special circumstances which gave the petitioners a right to the Order they asked. There were a number of creditors of the Company who were postponed to the debenture-holders, but who came in on the faith that the concern would have a fair trial.

The VICE-CHANCELLOR said if the Order were made to wind up, the petitioners would make an application to sell.

Mr. HIGGINS inquired what was the good of selling; and why should the general creditors be ousted of any rights they had? He admitted the general creditors of the Company for whom he appeared, to the amount of £3000 and odd, stood behind the debenture-holders. The income of the Company was now between £300 and £400 a year; and by the expenditure, at the outside, of £1000 by way of salvage money, the whole thing could be put upon its legs. What was the reasonable and proper thing to do? To see whether these gentlemen, by coming together, could not raise enough to make the Company a permanently good thing. The creditors said they were willing, with the debenture-holders, to contribute a sum of money to do so. His clients would be perfectly willing to find the money, and not even to have priority. He believed they had made an offer to the Company to find £1000 for salvage, and not ask for priority, but simply to come in *pari passu* with the other Shareholders. He was perfectly certain that such a reasonable offer Parliament would not disregard, and he asked the Court to dismiss the petition.

Mr. GLASSE, in reply, insisted that he was entitled to the Order asked for as a step towards obtaining justice.

The VICE-CHANCELLOR: I understand there is no probability of your making an amicable arrangement?

Mr. HIGGINS: They know perfectly well we have made them a most reasonable offer.

The VICE-CHANCELLOR: Seeing there is no prospect of an amicable arrangement being made, I must consider the not unimportant question which this petition raises—namely, whether a water-works company, established by Act of Parliament to supply a town with water, and who have also, by their Act of Parliament, power of borrowing money in furtherance of those objects, can be wound up, if there is default of principal and interest secured by the debentures. In the present case, the Act of Parliament was passed on July 15, 1867. It authorized the Company to raise £1200 by debentures, and the debenture-holders were to have the security of all the property of the Company, the general creditors standing behind them. Mr. Glasse has said that the petitioners advanced to the Company the whole amount the Company were authorized to raise by debentures — namely, £1200 — on Sept. 18, 1869. They took a security in the usual shape, giving them all the property of the Company for repayment of the principal, with interest at 6 per cent. per annum. It is admitted that not a single penny has been paid in respect of principal or interest from that day to this. The position of the petitioners, therefore, is certainly a very hard one, having for nine years been kept out of their principal and interest, and finding that, unless something is done, there is little hope of getting anything more in the future than in the past. What are their rights? There are certain creditors who have no right to call upon the debtor to pay. A man who lends money to the Government of England, has no right to call upon the Government to repay him. The holder of £100 Consols has a right to 3 per cent. per annum for ever, but he cannot call on the Government to repay the principal. The question is whether these mortgagees are entitled to say: We lent money in the ordinary way of mortgagor and mortgagee, and we are entitled to all the remedies of mortgagees; and if you do not pay, we will sell or foreclose. It is admitted they cannot sell or foreclose. Why are they deprived of those remedies? It must be because they do not stand in the position of ordinary mortgagees. If they have advanced their money under the Act of Parliament which gives them only one remedy, with that remedy they must be content. What is the security which this Act of Parliament gives to these creditors? The remedy the Act of Parliament gives is that the mortgagees of the Company may enforce payment of the arrears of interest and principal due upon their mortgages by the appointment of a receiver, and in order to authorize the appointment of a receiver, the amount owing to the mortgagees shall not be less than £500. And all moneys to be borrowed on mortgage under the Act are to have priority over all the property of the Company from time to time, and over every other creditor of the Company. When the money was advanced what had the proposed lenders to look to? It appears to me they were bound to look to the fact that they were lending money to establish a public object, and were therefore only entitled to the remedy which the Act of Parliament gives, which is the appointment of a receiver, who will be entitled to receive all the tolls of the Company until the whole principal and interest secured by the mortgage is paid. Beyond that, the lenders have no security whatever. Therefore, it seems to me that if the petitioners have lost their money they should try and make this concern yield a profit. Upon the whole, I think the case comes within the Exmouth case, in which I was guided, to a great extent, by the rules laid down by Lord Cairns in the case of the London, Chatham, and Dover Railway Company. It seems to me the petitioners have lent their money upon the security which the Act of Parliament tendered to them—namely, the appointment of a receiver, whose duty it is to receive all the tolls and earnings of the Company, and appropriate them to the benefit of the mortgagees until the whole of their principal and interest is paid. Consequently, this petition to wind up the Company cannot be sustained. I must, therefore, necessarily dismiss it; but I do not think I should dismiss it with costs.

Mr. HIGGINS: I hope your lordship will make the usual order.

The VICE-CHANCELLOR: It seems to me a case for a reasonable arrangement. In the Exmouth case I dismissed the petition without costs; but as it is pressed, I must dismiss this suit with costs, the petitioners not to pay the costs of any of the Company's affidavits.

THURSDAY, Nov. 7.

MASSEY *v.* THE NANTWICH LOCAL BOARD.

Mr. GLASSE, Q.C. (Mr. WILLIAM BARBER with him), said this case was before the Vacation Judge, upon an application for an order to restrain the defendants, the Local Board for the district of Nantwich, being the Urban Sanitary Authority for that district, from causing to fall or flow, or permitting to fall or flow, or to be carried into the River Weaver, any sewage matter, contrary to the provisions of the Rivers Pollution Act. The effect of the Act of Parliament was that, no matter how long the nuisance had subsisted, if it were not remedied within twelve months from the passing of the Act, a person aggrieved was at liberty to apply to the Court for an injunction, unless means were being taken to deodorize the sewage. The outfall sewers, of which complaint was made, rendered the river absolutely unbearable; but he admitted that they had been in existence for more than 20 years. The case was commenced in the County Court, and was removed to his Lordship's Court under the provisions of the Act, by which the Court had now jurisdiction; and the Act was intended to apply to old sources of nuisance as well as to new ones. Under section 13 it was said that proceedings could not be taken under the Act against any person for any offence against the provisions of parts 2 and 3 until the expiration of twelve months after the passing of the Act, nor should any proceedings in any cause be taken under the Act for any nuisance under the Act until the expiration of two months after written notice of the intention to take such proceedings had been given to the offender; nor should proceedings under the Act be taken for any offence under the Act while other proceedings in relation to such offence were pending. The twelve months had expired, and the two notices had been given. The plaintiff was a riparian owner, who, under the last clause of section 8, had a right to sue. That clause stated that proceedings might also, subject to the restrictions in the Act contained, be instituted in respect of any offence against the Act by any person aggrieved, and the question now was whether any offence was proved or not. That depended upon section 3, which required careful consideration, because it applied to existing, and not only to newly-made, sewers. The section stated that every person who caused to fall or flow, or knowingly permitted to fall or flow, or be carried into any stream any solid or liquid matter, should, subject as in the Act mentioned, be deemed to have committed a nuisance against the Act. When any sewage matter fell or flowed, or was carried into any stream along a channel used, constructed, or in process of construction at the date of the passing of the Act, for the purpose of conveying such sewage matter, the person causing, or knowingly permitting sewage to fall or flow, or be carried, should not be deemed to have committed an offence against the Act, if he showed, to the satisfaction of the Court having cognizance of the case, that he was using the best practicable and available means to render harmless the sewage matter falling or flowing, or being carried into the stream. The present case had reference to a town of 7000 inhabitants, with divers tan-yards, all the sewage and refuse from which was carried into the sewer without any attempt to deodorize or purify it, and some step must be taken.

The VICE-CHANCELLOR: They are using the old sewers without any improvement?

Mr. GLASSE: Yes, my lord. The contents of the sewers are flowing into and making the stream unbearable on account of its impurity, and the Local Board are bound to do something. They said it was very agreeable, and a learned doctor had said that he had put certain gold fish into the water, and they seemed to like it, and that gold fish were extremely delicate. He (Mr. Glasse) had always thought a gold fish was a carp, and lived in any muddy pond at the corner of a meadow.

Mr. BRISTOWE, Q.C. (Mr. EVERITT with him), said he represented the defendants, and it was a case which raised very important questions under the Act, and also a considerable amount of contest upon the evidence. It was quite clear that, having gone on for 20 years, it was evidently a case to stand for the hearing. When it came before Justice Hawkins on the 2nd of October he made an order to the effect that, the defendants, the Local Board, undertaking not in the meantime to make any new opening into, or communication with, the River Weaver, whereby any sewage or noxious matter could pass into the river, the motion should stand over. That was the order made in the Halifax sewage case, and in that case the matter stood until the hearing.

The VICE-CHANCELLOR said in Glossop's case, which gave him an immense amount of trouble, he at last sent it to an expert.

Mr. BRISTOWE said there was no pressure in this case. He would agree to continue the undertaking given, and that would enable his clients, who were a Local Board anxious to do that which was right and reasonable, an opportunity of considering what, in the meantime, could fairly and properly be done. They were not attacked by the Sanitary Authority, but by the plaintiff only.

Mr. GLASSE said a shilling rate would do all that was necessary, but the ratepayers said they liked it. The Court was relieved from anything which it had to consider in Glossop's case. This was a simple question of fact. The Act said, every person who caused to fall or flow, or knowingly permitted to fall or flow, or be carried into any stream, solid or liquid sewage matter, was subject, as in the Act mentioned, to be deemed to have committed an offence against the Act; and under the interpretation clause, "corporation" was a "person." According to their own evidence, there were 164 water-closets which drained into the river.

The VICE-CHANCELLOR: It must stand over until the hearing of the cause, the undertaking given before Justice Hawkins being continued. Will either side require further evidence?

Mr. BRISTOWE: I cannot say at this moment.

The VICE-CHANCELLOR: Let it stand over till the hearing of the cause. The undertaking will be continued, and there will be liberty to expedite the hearing.

LAMACRAFT *v.* THE ST. THOMAS'S UNION, DEVON, RURAL SANITARY AUTHORITY.

This was a similar motion to the foregoing one, and a like undertaking had been given. It was ordered to stand over for a fortnight, on the same terms as in the previous case.

QUEEN'S BENCH DIVISION.—TUESDAY, Nov. 5.

(*Sittings in Banco, before the* LORD CHIEF JUSTICE *and Justice* MELLOR.)

In re TWEEDALE *v.* THE ROCHDALE CORPORATION.

In this case a plaint had been filed in the Rochdale County Court against the Corporation of Rochdale (as the Sanitary Authority of the district), under the Rivers Pollution Act, for a breach of that Act, in throwing sewage into the river. The plaint having been fixed to be heard on the 13th inst., the Town Clerk made an affidavit that the case raised questions of great importance unfit to be dealt with in the County Court, and which could not be finally determined there, but were fit to be decided in the High Court of Justice. Upon this, application was made to the Judge at chambers (Justice Field) for an order to restrain the County Court Judge from proceeding; but he declined to grant any such order, observing that he would much rather make an order to restrain the Corporation from throwing sewage into the river.

Mr. CRUMP now moved, on the part of the Corporation, for an order to remove the case into this Court. The case, he said, could not be finally determined in the County Court, as there was an appeal given on the merits, and the case would certainly come before the High Court on appeal, as it raised the whole question of drainage and the mode of disposing of sewage, and the Corporation were resolved that it should be finally decided in the High Court, so that it would be merely throwing away expenses to allow the case to be heard in the County Court. It was far better, therefore, that the case should be at once removed to this Court.

After a short discussion, a rule *nisi* was granted.

EXCHEQUER DIVISION.—MONDAY, Nov. 4.

(*Sittings in Banco, before the* LORD CHIEF BARON *and Baron* CLEASBY.)

WELLS *v.* MITCHAM AND WIMBLEDON GAS COMPANY.

Mr. J. BROWN, Q.C., on behalf of the defendants, appealed from an order made by Baron Huddleston, refusing to interfere with a decision made by Master Johnson, who had allowed the plaintiff, in the bill of costs between party and party, a sum of £149 for several copies of shorthand writers notes. He (Mr. Brown) said that the question raised was one of considerable importance to solicitors. The action was brought by a builder to recover upon a contract to erect certain buildings for £5000. The defendants alleged that the work had not been properly done, and claimed some deductions. The case went before an arbitrator, and occupied 33 days. An award of £950 was finally made in favour of the plaintiff, and £433 in favour of the defendants. The plaintiff, therefore, obtained a balance in his favour of £517, and was awarded his costs, which amounted to £1375. The learned Master had not allowed for the attendance of the shorthand writers, or for the actual note-taking, but had, nevertheless, allowed the charge of £149 for copies of the notes for the use of counsel and solicitor, and also for the attendance of the solicitor and his clerk. He (Mr. Brown) submitted that those two gentlemen could have taken a sufficient note for the purposes required, and that the sum of £149 should not be allowed in the plaintiff's costs.

Mr. GATES, Q.C., opposed the motion on behalf of the plaintiff, and represented that the plaintiff had been disallowed a sum of £358 for the attendance of the shorthand writer and for the first transcript. The arbitration had lasted a period of 34 days, and as fresh points were liable to crop up as the case went on, the Master had exercised the discretion given him, and allowed the reduced sum of £149. He submitted such a decision should not be disturbed.

The LORD CHIEF BARON considered that a charge such as that complained of should not be allowed, and that the decision of the Master must, therefore, be returned to him for the necessary alteration.

Baron CLEASBY concurred.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

Metropolitan Board of Works.

At the Meeting of the Board last Friday—Sir J. M. Hogg in the chair,

Mr. Saunders (in the absence of Mr. H. L. Taylor, who had given the notice) moved—"That a return (in detail) be presented to the Board of the cost, so far as it has been ascertained, which has been incurred in preparing evidence, and for professional charges, experiments, and all other charges and expenses in connection with the Bills laid before the House of Commons last session, having for their object the purchase of the existing Water Companies, and a new supply of water to the Metropolis."

Mr. Runtz seconded the motion, which was agreed to.

St. Olave's District Board of Works.

At the Meeting of this Board on Tuesday last—Mr. G. L. Shand presiding,

Mr. Besley moved—"That in view of the increasing severity of the burdens imposed upon the ratepayers of the Metropolis by the Metropolitan Board of Works, it is desirable, for the future, for the representatives of districts at that Board to avoid as much as possible entering upon any schemes involving large outlay of the ratepayers money, and which are likely to lead to contests in Parliament." He said that the amounts expended by the Metropolitan Board were yearly increasing, although, in consequence of the increased assessment, they kept the rate at the same figure. However, he knew, as a large ratepayer, that he had to contribute 30 per cent. more to the Board than he did in 1872. He criticized the expenditure of the Board with respect to Bills in Parliament, and said they went into the Legislature with Bills in a most precipitate manner, and the result was that they failed to obtain the assent of Parliament to their measures. He believed the time had arrived when the Board should hold their hands; but that was not the opinion of the members, and he therefore proposed this motion, hoping not only to get it passed but to obtain the support of the Local Authorities in the Metropolis and the ratepayers generally.

Mr. Elmslie, in seconding the motion, expressed his fear that the Board were trying to do too much, and had certainly lost the confidence of the Government by their treatment of the Thames floods question. As a member of the Thames Conservancy Board he knew that report after report had been sent to the Board, calling attention to the fact that sewage found its way into the river; but Sir John Bazalgette had denied the statement, which, however, was a fact now patent to all.

Mr. Tolhurst defended the Board from extravagance, and urged that they were obliged, in order to satisfy the natural requirements of the public, to initiate legislation.

After further discussion the motion was carried unanimously, and it was resolved that a copy of it should be forwarded to the Vestries and District Boards of the Metropolis.

Chelsea Vestry.

At the Meeting of this Vestry last Wednesday—Mr. E. Kingsbury in the chair,

Mr. Dillon moved, and it was unanimously agreed to—"That this Vestry request their representative at the Metropolitan Board of Works to afford this Vestry information from time to time as to the steps being taken by the Metropolitan Board of Works with respect to the water supply of the Metropolis. Also, whether the statement is correct that the Metropolitan Board, on the 11th of October last, rejected a motion for the return of the expenditure entailed by the Board in promoting the Water Bills last session; and, if so, to ask him to explain to the Vestry how such rejection was for the benefit of the Metropolitan ratepayers."

SUTTON (SURREY) GAS COMPANY.

The Ninth Half-Yearly Meeting of this Company was held on Thursday, the 31st ult.—C. E. Amos, Esq., in the chair.

The Secretary (Mr. Frank Mead) read the following report:—

The Directors herewith submit the statement of accounts for the half year ending June 30, 1878.

The profit and loss account shows a balance available for dividend of £1592 9s. 5d., from which sum the Directors recommend the payment of maximum dividends, less income-tax. This will absorb £1241 1s. 11d., leaving a balance of £351 7s. 6d. to be carried to next account.

Dr.—*Revenue Account, for the Half Year ended June* 30, 1878.

To Manufacture of gas—			
Coals, including all expenses	£1310 7 4		
Purifying materials, oil, water, and sundries	55 0 5		
Wages and gratuities	226 0 3		
Repairs and maintenance of works and plant, materials, and labour	277 18 6		
		£1869 6 6	
Distribution of gas—			
Repairs and renewal of meters		13 9 6	
Ditto of mains and services		60 11 1	
Public lamps—			
Lighting and repairing		97 2 1	
Rent, rates, and taxes—			
Rates and taxes		63 15 6	
Management—			
Directors allowances	£175 0 0		
Salary of Secretary	57 10 0		
Collector and Clerk	152 2 10		
Stationery and printing	26 10 8		
Auditors	12 0 0		
		423 3 6	
General charges		25 13 1	
Parliamentary opposition		100 0 0	
Deposit interest		10 5 0	
Total expenditure		£2663 6 4	
Balance carried to profit and loss account		1342 19 6	
		£4006 5 10	

Cr.—*Revenue Account.*

By Sale of gas—			
Private rental—			
10,447,000 cubic feet, at 5s. 6d.	£2873 3 3		
Public rental and under contracts	772 10 7		
	£3645 13 10		
Less discounts allowed	283 10 5		
		£3362 3 5	
Rental of meters		73 19 6	
Residual products—			
Coke, less labour and cartage	£312 18 10		
Tar, ditto	92 8 1		
Ammoniacal liquor	81 16 4		
		487 3 3	
Transfer fees		0 5 0	
Services		82 10 8	
Sale of special Act		0 4 0	
		£4006 5 10	

The Chairman moved, and Mr. J. T. Overton (Vice-Chairman) seconded, the adoption of the report and balance-sheet.

Mr. Steele inquired where the sum of £226 0s. 3d., put down in the balance-sheet under the head of "Wages and gratuities," went.

The Secretary said that this amount was paid to the men for gas-making at the works.

Mr. Steele asked how much of the sum of £209 12s. 10d., under the heads of "Secretary's salary" and "Collector and clerks" the Secretary received.

Mr. C. R. Mead explained that the Secretary receives the sum of £57 10s. for the half year, and that the Collector was paid 2½ per cent. on the sum collected, he being responsible for all bad debts.

The motion was then agreed to, and it was unanimously resolved that the maximum dividends of 10 and 7 per cent. on the original and additional capitals respectively be declared and paid, less income-tax.

A vote of thanks to the Chairman and Directors terminated the meeting.

OPENING OF A NEW GASHOLDER AT SOWERBY BRIDGE.

On Saturday, the 26th ult., a new gasholder, which has been for some time past in course of construction at the gas-works of the Sowerby Bridge Local Board, was formally opened by Mr. J. Greenwood, the Chairman of the Gas Committee, turning the gas into it, in the presence of a considerable number of invited guests. He subsequently presided at a luncheon which was served in the mess-room of the works.

In response to the toast of his health, the Chairman said that he had prepared a few facts and statistics relating to gas, and especially to the history of gas-making at Sowerby Bridge. Gas was first discovered at Whitehaven in 1733, through a flame 3 feet in circumference and about 9 feet high issuing from a pit. It was first used for lighting purposes on a large scale in Paris in 1799; and in London, at the Mint and other public places, in 1817. Sowerby Bridge had always contained spirited individuals, and he found that in 1805, Mr. Clegg, a pupil of Messrs. Bolton, Watt, and Co., lighted up with gas the cotton-mill of Mr. Henry Lodge at Sowerby Bridge. Lime for gas-purifying purposes was first used at Mr. Henry Lodge's house. The Sowerby Bridge Gas Company were formed in 1835, with a capital of £7000. Gas at that time was burnt by the hour, and was turned off at nine o'clock at night. Meters were first used in Sowerby Bridge in 1837. In December, 1860, a bill was posted asking the question—Who is to supply the gas? On the 27th of that month, a meeting was held, when Mr. J. Greenwood proposed, and Mr. Shepherd seconded, a motion that the Local Board were the proper authority to supply it, and this was carried. The old and a new company were then fighting together in London, but they arranged that the Board should have the works. A second meeting of the ratepayers took place, and were asked to sanction the arrangement come to in London, which they did. At the Local Board meeting following, it was reported that arrangements had been made to purchase the works for £18,196, paying all expenses up to March 31, 1861. The Gas Committee of the Local Board held their first meeting in April, 1861, when they took into consideration three subjects—the extension of the gas-works, the passing of the Bill through Parliament, and where the money was to come from. The quantity of gas made in November, 1860, was 3,150,000 feet, and there was storeage room for 60,000 feet. The present storeage room was for 330,000 feet, and the consumption in the month of November was about 6,113,000 feet. Up to the present date the gas-works had cost the Local Board £55,500, and the present value of the property, as set down in the books of the Board, was £43,729. The amount taken from gas profits for sewerage and street improvements was £4625. He concluded by proposing the health of the Vice-Chairman of the Gas Committee (Mr. James Wood), with whom, he said, he had worked for more than 20 years. They had sometimes varied, but he believed they had both worked with the best intentions for the good of the town.

Mr. Wood having acknowledged the compliment, several other toasts were proposed, and the proceedings shortly afterwards closed.

In continuation of the above celebration commemorative of the completion of the extension of the gas-works, the men employed at the works, both on the regular staff and those who had assisted in the extensions, dined together at the Oddfellows Arms, Bolton Brow. The dinner was provided by the Chairman of the Gas Committee, the Contractors, and other friends. Mr. G. E. Saville, the Manager of the works, presided, and a most agreeable evening was spent. In the course of the proceedings, thanks were returned to the gentlemen to whose liberality the men were indebted for the pleasure they had enjoyed, and the gathering broke up with the singing of the National Anthem.

East Grinstead Gas and Water Company.—The first ordinary general meeting of this Company, since their Act of Parliament—session 1878—was obtained, was held on Tuesday, Oct. 29, when Mr. Stenning was voted to the chair. The register of Shareholders in the new Company having been sealed, Messrs. T. Cramp, C. Absalom, E. Gatland, H. Taylor, G. S. Head, and W. V. K. Stenning were appointed Directors for the coming year. On the question of the remuneration of the Directors some discussion ensued. It was proposed to allow them £100 a year; but this being considered too much, it was resolved that they be paid £60 for the first year, to be divided as they may think fit. Mr. E. A. Head and Mr. Bridgland were elected Auditors, one to retire at the end of the year; their remuneration being settled at two guineas each. In the course of the meeting it was stated that 608 of the £10 shares had been already applied for. The capital of the old Company was £3000, while that of the new is £12,000.

Hull Corporation Water Supply.—At the meeting of the Hull Water-Works Committee on Monday, the 20th ult., the Borough Engineer (Mr. D. Maxwell) presented his annual report, which was as follows:—

Summary of the Water Supplied, Coals Consumed, and Wages Paid at the Water-Works for the last Seven Years.

	Years ending Sept. 29. Average of Years, 1872-3-4.	Average of Years, 1875-6-7.	1878.
Water pumped, million gallons	1660	1799	1958
Coals consumed at both stations	5484 tons.	4955 tons.	4630 tons.
Cost of ditto	£6093	£3284	£2393
Coals at both stations, per million gallons	66·1 cwt.	55·1 cwt.	47·3 cwt.
Cost of ditto	£3 13s. 2d.	£1 16s. 6d.	£1 4s. 5d.
Wages and coal delivery, Springhead	£861 18 4	£1004 6 6	£1049 1 0
Wages ditto, Stoneferry	1404 0 0	996 10 9	874 18 6
Wages of Turncocks, Pipe-layers, and Clerks in Engineer's office	2006 2 1	1304 7 7	1337 8 0
Total wages paid	£4272 0 5	£3305 4 10	£3261 7 6
Wages per million gallons pumped	2 11 6	1 16 9	1 13 4
Coals and wages ditto	6 4 8	3 13 3	2 17 9

The price of coals during last year tended downwards, the average price being less than half what it was five years ago. Not being under any contract, and only buying as required, I have been able to purchase at unusually low prices. Were the market to show a decided rising tendency, it might be advisable to contract. As the town supply increases with increasing population, the wages, as well as many other items in our expenditure (interest on loans, payment to borough-fund, establishment charges, salaries, rates, &c.), will be comparatively less per million gallons pumped.

AUCKLAND (NEW ZEALAND) GAS COMPANY, LIMITED.

The Sixteenth Annual Meeting of this Company was held on Wednesday, Aug. 1—Mr. THOMAS MACFARLANE in the chair.

The SECRETARY (Mr. E. B. Parsons) read the following report:—

The Directors submit herewith the annual statement of accounts certified by your Auditors.

For a considerable period your Directors have had under their anxious consideration the necessity of providing more storeage room for gas. Several parcels of land, more or less suitable for the immediate requirements of the Company, were to be obtained; but your Directors, looking to the future, resolved to purchase the freehold of a block of land, of seven acres, at Freeman's Bay, its situation being in every way most suitable for the object in view.

After making liberal provision for the maintenance of the works, there remains a sum of £3720 9s. 3d. to the credit of the profit and loss account. From this the Directors propose paying the usual dividend of 7s. 6d. per share, for the past six months. This will leave a balance of £843 16s. 9d. to be carried forward.

The Directors retiring by rotation are C. J. Stone and F. Whitaker, Esqs., who, being eligible, offer themselves for re-election.

The Auditors, Messrs. A. Boardman and G. Pierce, also retire, and again present themselves for re-appointment.

DR.—*General Balance-Sheet, June 30, 1878.*

To Capital account—			
10,000 shares at £5	£50,000 0 0		
Uncalled capital	11,645 0 0		
Paid-up capital on 7671 shares at £5		£38,355 0 0	
Premium on shares sold	£5,243 11 8		
Profit expended on permanent works	3,256 5 1		
		8,499 16 9	
			£46,854 16 9
Amounts owing by the Company			167 7 9
Dividends unclaimed			15 0 0
Reserve-fund, balance at credit thereof			3,920 0 3
Profit and loss, balance at credit thereof			3,720 9 0
			£54,677 13 9

CR.—*General Balance-Sheet.*

By Expenditure on capital account—			
Freehold and leasehold land, buildings, manufacturing and distributing plant, and meters	£45,487 12 0		
Stock of mains, service-pipes, meters, tools, and materials unemployed	3,242 0 0		
		£48,729 12 0	
Stock of coal and shale	£1,032 14 2		
Stock of residual products	616 13 1		
		1,649 7 3	
Amounts owing to the Company		521 8 4	
Cash in the Bank of New Zealand		777 6 2	
Debentures, reserve-fund investment		3,000 0 0	
		£54,677 13 9	

DR.—*Profit and Loss Account, for the Year ending June 30, 1878.*

To Coals carbonized			£5,553 5 5
Stokers wages			860 17 0
Distribution of gas and meter inspection			153 2 0
Water at works			14 8 6
Insurance			8 5 0
Wear and tear			1,410 1 3
General expenses—			
Directors and Auditors	£250 0 0		
Salaries	1,056 0 0		
Stationery, printing, advertising, and stamps	160 12 9		
Petty cash	19 10 7		
Legal expenses	6 6 0		
Rent	165 0 0		
Rates and taxes	379 10 9		
		£2,035 0 1	
Interest		120 14 10	
Bad debts		44 4 2	
Balance carried down		4,487 7 10	
		£14,687 6 1	

CR.—*Profit and Loss Account.*

By Gas			£13,141 15 10
Residual products			1,539 4 9
Transfer fees			6 5 6
			£14,687 6 1
By Balance at credit, June 30, 1877	£4,498 16 5		
Balance brought down	4,487 7 10		
		£8,986 4 3	
Less dividend declared July, 1877, £2539 2s. 6d., and interim dividend, January, 1878, £2726 12s. 6d.		5,265 15 0	
		£3,720 9 3	

The CHAIRMAN, in moving the adoption of the report and accounts, said that, at the previous meeting, the Shareholders were informed that the greatly-increased consumption of gas would render it necessary to make large additions to the works and working plant. With the view of enabling this to be done, the Directors had recently purchased property in Freeman's Bay, which would enable the Company to supply all demands upon them which could possibly be made in after years. In regard to the accounts, he remarked that the consumption of gas was very encouraging. The receipts for the first quarter of last year were in excess of the same quarter of this year by £500; but this arose from the fact that the price of gas then was 1s. 3d. per 1000 feet higher than during the corresponding quarter of this year, the reduction in price having been made in September. The indices of the meters, moreover, were taken this year five days earlier than last year, thereby lessening the income by £270. This step was rendered necessary by the increase in the number of consumers. The coal account suffered, when compared with that of last year, to the extent of £163. This arose from the fact that last year several cargoes of coal came into the harbour without being specially ordered, and these the Directors purchased at a price equal to the difference stated; but this year no similar opportunity had occurred. Another thing was the increase in the wages account. This was occasioned solely by the increase in the demand for gas, and of that expenditure the Company would derive the benefit for years to come. It also became necessary, during the year just closed, to renew four benches of retorts. This also was a heavy charge against the income of the year, and swelled unusually the item of wear and tear. But, on that very account it might fairly be hoped that next year's account would show a proportionate reduction on this item. On the other side of the accounts it would be seen that the sales of the residual products were scarcely more than last year's; but this was owing to the fact that a large stock of coke was taken over at 30s. per ton, but was sold at 20s.—it having been deemed advisable to sell it at the lower price. One reason which induced the Directors to reduce the price was the difficulty of getting drays to carry it away from the works—the roads being so bad. However, this product had been carefully advertised by the Directors, and the result was highly satisfactory, the sales having been doubled, and every one who had used it admitted readily that it was a most valuable and economical fuel.

Mr. R. KEESING seconded the motion.

Mr. G. P. PIERCE said that in looking over the report of the Wellington (New Zealand) Gas Company he found the extension of mains during the year was mentioned. He thought it would be advisable if the Auckland Company notified the number of miles (or otherwise) over which their operations extended from year to year. There was also another thought suggested by a comparison of the report of the Auckland Company with that of the Wellington Company which was worthy of notice. The gas-rates and meter-rents at Wellington amounted to £14,700. In Auckland they amounted to about £13,000. The amount owing to the Company in Auckland was only £521, as compared with Wellington, where the gas-rates due were shown to be £1807. This was a fact which reflected great credit on the management of the Auckland Company and the Directors. He was glad to bear testimony to the excellent manner in which the accounts had been kept.

Mr. J. NEWMAN said there was one cause of the difference between the present and last year's expenditure which the Chairman had omitted to mention. The Company in making their extensions, had to purchase the mains before laying them, and paid for them long before any consumption recouped such payment. This was the case in respect of some of the 8-inch mains. He believed what was now being done would result to the benefit of the Company.

The CHAIRMAN, in reply to questions, said the cost of the seven acres of land at Freeman's Bay was £3000. The Company would have the right to water frontage.

The motion was put and carried unanimously.

The retiring Directors were re-elected, and Mr. Stark was elected a Director in the room of Mr. R. Wood, absent in England.

The Auditors were then re-elected and, a vote of thanks having been passed to the Chairman, the meeting separated.

BRISBANE (QUEENSLAND) GAS COMPANY.

The following are the report of the Directors and the accounts of this Company for the year ending June last:—

In this (their 26th) report your Directors have the pleasure of informing you that the proposed enlargement of the works has been in a great measure completed during the past six months. The new retort-house and coal-sheds are finished; a substantial wharf has been erected; and a tramway and steam winch, for discharging coal with dispatch and economy into the new sheds, will shortly be ready for use. Your Directors also contemplate the excavation of the tank and the erection of a holder for South Brisbane before the end of the year. A photometer and other appliances, for testing the illuminating power and quality of the gas, have been ordered, and it is expected will be ready for use before the end of the present year. The Company's business for the half year has been of a satisfactory and progressive character.

The net amount at credit of profit and loss is		£2538 5 3
Balance from last half year		195 12 9
		£2733 18 0
After placing to credit of reserve-fund		1000 0 0
There will remain for distribution		£1733 18 0
Out of which a dividend at the rate of 10 per cent. per annum, and a bonus of 2s. 6d., is recommended, absorbing		1500 0 0
Leaving to be carried forward		£233 18 0

DR.—*Balance-Sheet, June 30, 1878.*

To Capital			£20,000 0 0
Reserve (expended in extensions, &c.)			12,302 0 9
Dividends for last half year not yet paid			13 10 0
Unclaimed dividends			56 3 6
Deposits in security			551 4 2
A. M. P. Society			9,500 0 0
Profit and loss	£1,538 5 3		
Balance from last half year	195 12 9		
		1,733 18 0	
			£44,156 16 5

CR.—*Balance-Sheet.*

By Land and buildings			£12,711 11 6
Office furniture			150 14 5
Plant in stock	£3,972 12 11		
Plant in use (at cost)	24,911 17 10		
	£28,884 10 9		
Less written off	3,402 12 0		
		25,481 18 9	
Residual products in stock		129 10 8	
Coal		298 2 4	
Lime		10 8 9	
Sundry persons	£2,156 15 7		
Less discount	395 9 6		
		1,761 6 1	
Cash		13 10 0	
Fixed deposit		2,000 0 0	
A. J. S. Bank		1,599 13 11	
		£44,156 16 5	

DR.—*Profit and Loss Account, for the Year ending June 30, 1878.*

To Manufacture	£2,922 9 1
Distribution	112 19 9
Management	516 19 10
Public lighting	37 13 9
Rates and taxes	31 0 0
Bad debts	29 4 11
Interest	32 5 6
Depreciation of plant	218 8 9
Reserve	1,000 0 0
Balance	1,733 18 0
	£6,634 18 10

CR.—*Profit and Loss.*

By Balance from last half year			£195 12 9
Sales of gas, &c.	£7,776 18 6		
Less discount	1,759 1 7		
		6,017 16 11	
Sale of other products		371 9 2	
Rent		50 0 0	
		£6,634 18 10	

THE AWARD IN THE BRIGHTON GAS EXPLOSION CASE.—Our readers may remember that the liability of the Corporation of Brighton for the damage caused by the explosion of gas which occurred on the 14th of March last year, having been settled by the test action tried at the Sussex Spring Assizes, and reported in the JOURNAL, Vol. XXXI., p. 429, the amount to be paid was referred to arbitration. At the meeting of the Brighton Town Council on Wednesday, the 30th ult., the Mayor reported that the award just received was for £4498 6s. 4d., the amount claimed having been £11,675.

INSTITUTION OF CIVIL ENGINEERS.

The Council of this Institution have just published a list of subjects upon which, as well as upon other analogous questions, they invite communications of a complete and comprehensive character. For approved original communications, the Council will be prepared to award premiums, arising out of special funds bequeathed for the purpose, the particulars of which are as under:—

1. The Telford Fund, left "in trust, the interest to be expended in annual premiums, under the direction of the Council." This bequest (with accumulations of dividends) now produces about £260 annually.

2. The Manby Donation, producing about £10 per year, given "to form a fund for an annual premium or premiums for papers read at the meetings."

3. The Miller Fund, bequeathed by the testator "for the purpose of forming a fund for providing premiums or prizes for the students of the said Institution upon the principle of the 'Telford Fund.'" This fund (with accumulations of dividends) now realizes nearly £180 per annum. Out of this fund the Council have established a scholarship—called "the Miller Scholarship of the Institution of Civil Engineers"—and are prepared to award one such scholarship, not exceeding £40 in value, each year, and tenable for three years.

4. The Howard Bequest, directed by the testator to be applied "for the purpose of presenting periodically a prize or medal to the author of a treatise on any of the uses or properties of iron, or to the inventor of some new and valuable process relating thereto, such author or inventor being a Member, Graduate, or Associate of the said Institution." The annual income amounts to rather more than £16. It has been arranged to award this prize every five years, commencing from 1877. The next award will therefore be made in 1882.

The Council will not, in any case, make an award unless a communication of adequate merit is received; but, on the other hand, more than one premium will be given, if there are several deserving memoirs on the same subject. In the adjudication of the premiums no distinction will be made between essays received from a Member, an Associate, or a Student of the Institution (except in the cases of the Miller and the Howard bequests, which are limited by the donors), or from any other person, whether a native or a foreigner.

The following subjects, among others, are named in the list:—

The Effect of the Lapse of Time on the Strength of Materials strained beyond the supposed Limit of Elasticity, but within the ultimate Strength.

The Causes of Slips in Rocks and Earths of different kinds, and the Conditions that induce Treacherous Ground in Railway Cuttings, Tunnels, and the Sides of Valleys, near Reservoir Banks.

The best Combined System of Warming, Ventilating, and Lighting large Buildings.

The Design and Construction of Moveable Weirs across Rivers.

The Storeage and Filtration of Water, both Natural and Artificial, and the Arrangements for the Distribution of Water in Towns.

The Systems of Domestic Water Supply suitable for Rainless Districts.

The Relative Advantages of Steam, Heated Air, Gas, Water, and Electricity as the Motive Power in Small Engines.

The Various Descriptions of Pumps employed for Raising Water or Sewage, and their Relative Efficiency.

The "Output" of Coal in the United Kingdom, as compared with that of other Countries, illustrated by Statistics, showing where Coal is Produced, Where and How it is Consumed, and the relative Quantities Exported.

The Management of Underground Waters in Mining Districts, and the Relative Economy of Distributed or Trunk Pumping-Engines, Adits, &c., in Particular Cases.

The Application of Electricity to Lighting Purposes, contrasted with the best Systems of Lighting at present in Use.

Instructions for Preparing Communications.

The essays should be written in the third person, and be legibly transcribed on foolscap paper, on one side only, leaving a margin on the left side, in order that the sheets may be bound. Every paper must be prefaced by a concise abstract.

Illustrations, when necessary, should be drawn on tracing paper, to as small a scale as is consistent with distinctness, and ready to be engraved. When an illustrated communication is accepted for reading, a series of diagrams will be required sufficiently large and boldly coloured to be clearly visible at a distance of 60 feet. These diagrams will be returned.

Papers which have been read at the meetings of other societies, or have been published in any form, cannot be read at a meeting of the Institution, nor be admitted to competition for the premiums.

The communications must be forwarded to the Secretary of the Institution, from whom any further information may be obtained.

CHARLES MANBY, Honorary Secretary.
JAMES FORREST, Secretary.

BURNLEY CORPORATION GAS-WORKS.

The following accounts of the gas department of the Burnley Corporation, for the year ending June 30, 1878, and an analysis prepared by the Engineer (Mr. Samuel Petty Leather), were presented at the last meeting of the Gas Committee, who passed a resolution recommending the Council to reduce the price of gas from 3s. to 2s. 6d. per 1000 cubic feet:—

DR.—*Capital Account, June 30, 1878.*

—	Expenditure to June 30, 1877.	Expended this Year.	Total to June 30, 1878.
	£ s. d.	£ s. d.	£ s. d.
To Expenditure in purchase of old works, Jan. 1, 1855	31,299 11 11	—	31,299 11 11
Since that Date.			
Lands, &c., acquired, including law charges	4,345 2 7	—	4,345 2 7
New buildings, manufacturing plant, machines, storeage works, & other structures connected with manufacture	30,500 6 11	1,880 10 2	32,380 17 1
New mains and service-pipes, not being in place of old ones, including laying the same, paving, and other works connected with distribution	18,626 7 2	3,693 17 10	22,320 5 0
New meters, not in place of old ones.	10,671 11 4	696 7 11	11,367 19 3
New lamps and pillars, including services and fixing	1,358 17 7	92 0 5	1,450 18 0
Sulphate of ammonia works	903 10 5	378 5 1	1,281 15 6
Tramway for conveying coal to works.	955 6 6	323 17 0	1,279 3 6
Total expenditure			£105,725 12 10
Balance			5,542 18 9
			£111,268 11 7

CR.—*Capital Account.*

—	Certified Receipts to June 30, 1877.	Received during Year.	Total Receipts to June 30, 1878.
	£ s. d.	£ s. d.	£ s. d.
By Amount of loan from borough-fund	—	—	45,801 11 2
Amount of loan from Commissioners of Public Works	—	—	1,083 6 8
Amount of surplus-fund	—	—	34,503 8 11
Ditto depreciation (renewal) fund	—	—	29,880 4 10
	—	—	111,268 11 7

DR.—*Revenue Account, for the Year ending June 30, 1878.*

—	—	—	Cost per Ton of Coal.	Cost per 1000 Cub. Ft. Sold.
	£ s. d.	£ s. d.	s. d.	s. d.
To Manufacture of gas—				
Coal and cannel, including carriage, unloading, and all expenses of depositing same on works	10,397 9 6	—	12 4·429	1 4·516
Purifying materials and wages.	333 14 0	—	0 4·764	0 0·530
Salaries of Engineer and Foreman, &c.	432 16 8	—	0 6·179	0 0·688
Wages and gratuities at works.	2,350 10 1	—	2 9·554	0 3·734
Repairs and maintenance of works and plant, including renewal of retorts, machines, apparatus, tools, materials, and labour	3,361 16 1	—	3 11·992	0 5·340
		16,876 6 4	20 0·918	2 2·808
Distribution of gas—				
Salaries of Meter Inspectors and Assistants	279 7 4	—	0 3·988	0 0·444
Repairs, maintenance, and renewal of mains and service-pipes, including materials, laying, paving, and labour	704 10 4	—	0 10·057	0 1·119
Repairing, renewing, and refixing meters	317 10 3	—	0 4·532	0 0·504
		1,301 7 11	1 6·578	0 2·067
Public lamps—				
Lighting and repairing lamps.	—	405 15 9	0 5·793	0 0·645
Rents, rates, and taxes—				
Rents	203 18 7	—	0 2·911	0 0·324
Rates and taxes	536 0 4	—	0 7·652	0 0·851
		739 18 11	0 10·563	0 1·175
Management—				
Salaries of Town-Clerk, Accountant, Clerks, &c.	401 13 11	—	0 5·734	0 0·638
Collectors	222 0 8	—	0 3·170	0 0·353
Stationery and printing	111 9 9	—	0 1·590	0 0·177
General establishment charges and incidentals	23 17 7	—	0 0·341	0 0·038
Auditors	20 16 8	—	0 0·290	0 0·033
		779 18 7	0 11·134	0 1·239
One-third portion of town's survey	—	102 16 10	0 1·468	0 0·163
Total expenditure.	—	20,206 4 4	24 0·454	2 8·097
Balance carried to profit and loss account	—	10,610 18 3	12 7·476	1 4·855
		30,817 2 7	36 7·930	4 0·952

CR.—*Revenue Account.*

—	—	—	Per Ton of Coal.	Per 1000 Cub. Ft. Sold.
	£ s. d.	£ s. d.	s. d.	s. d.
By Sale of gas—				
138,344,880 cubic feet within the borough, at 3s. per 1000.	20,751 14 8	—	—	—
789,520 cubic feet outside the borough, at 4s. 6d. per 1000.	177 12 10	—	—	—
Public lighting and under contracts	1,995 0 10	—	27 3·258	3 0·415
		22,924 8 4		
Rental of meters	—	1,304 0 2	1 6·615	0 2·071
Residual products—				
Coke, less labour and cartage.	2,661 18 0	—	3 2·000	0 4·259
Tar	1,893 13 10	—	2 3·033	0 3·029
Ammoniacal liquor	4 17 2	—	1 9·884	0 2·453
Sulphate of ammonia, less cost of manufacture, &c.	1,528 2 8			
Spent lime	40 12 4	—	0 0·380	0 0·065
		6,129 4 0	7 3·497	0 9·736
Rents	—	73 8 0	0 1·048	0 0·117
Sale of water	10 0 0	—	—	0 0·016
Profit on fittings	373 2 9	—	—	0 0·593
Discounts	2 19 4	—	—	0 0·004
		386 2 1	0 5·512	0 0·613
Total receipts		30,817 2 7	36 7·930	4 0·952

DR.—*Profit and Loss (or Net Revenue) Account.*

To Interest paid on borrowed money	£2,048 0 10
Amount paid for reduction of debt to borough-fund	1,055 15 0
Amount paid for reduction of debt to Commissioners of Public Works	66 13 4
Amount carried to capital for depreciation-fund	1,344 4 0
Interest paid on consumers deposits	49 8 10
Balance carried to borough-fund revenue account for reduction of rates	6,046 18 3
	£10,610 18 3

CR.—*Profit and Loss (or Net Revenue) Account.*

By Balance from revenue account	£10,610 18 3
	£10,610 18 3

Statement of Coals.

Description of Coal.	In Store, June 30, 1877.	Received during the Year.	Carbonized during the Year.	In Store, June 30, 1878.
	Tons.	Tons.	Tons.	Tons.
Coal	878	14,775	14,863	788
Cannel	241	2,109	1,947	403

Statement of Residual Products.

—	In Store, June 30, 1877. (Estimated)	Made during the Year. (Estimated)	Used in Manufacture during the Year. (Estimated)	Sold during the Year.	In Store, June 30, 1878. (Estimated)
	Tons.	Tons.	Tons.	Tons.	Tons.
Coke.	None.	10,591	3,311	7,280	None.
Tar	None.	1,149	—	1,149	None.
Sulphate of ammonia.	1·55	121·59	—	120·34	2·8

Gas made	160,920,000 cubic feet.
Gas sold	151,088,000 ,,
Gas used on works	1,135,000 ,,
Gas unaccounted for	8,697,000 ,, or 5·40 per cent.
Coal and cannel used	16,812 tons.
Gas made per ton	9,571 cubic feet.
Gas sold per ton	8,987 ,,
Capital expended per ton of coal. . .	£6 5s. 9·288d.
Tar sold per ton of coal	147·6 lbs.
Sulphate of ammonia sold per ton of coal	16·4 lbs.
Cost of coal and cannel per ton . . .	12s. 4·429d.
Value of residuals sold	7s. 3·497d.
Net cost of coals per ton	5s. 0·932d.

WARRINGTON CORPORATION GAS SUPPLY.

A Special Meeting of the Warrington Town Council was held on Tuesday, the 29th ult.—the MAYOR (Mr. J. Fairclough) presiding—when the Gas Committee reported that at their meeting on the 18th of October, the question of the further extension of the gas-works was discussed, and it was resolved that 16 acres of land belonging to Col. J. Blackburne, adjoining the London and North-Western Railway Company on the north, the Longford Iron Company on the south, and Winwick Road on the east, and land belonging to Lord Winmarleigh on the north, be purchased on lease for a term of 999 years, at an annual rental of 1½d. per yard, or £605 per acre.

Alderman HEPHERD, in moving the adoption of the minutes of the Committee, said the Council would remember that at their last meeting a report was read from Mr. James Paterson, Gas Engineer, wherein he said it was necessary that the extension of the works should be commenced in a short time. Acting upon that report, the Committee, after carefully weighing all considerations, came to the conclusion that they could not do better than purchase the land mentioned in the report, inasmuch as the conveniences in all respects were such as, perhaps, were not presented in other pieces of land in the borough. It adjoined the London and North-Western Railway, and the Committee had an interview with the Company's Engineer and the principal Goods Manager on the spot, and he (Alderman Hepherd) was glad to be able to report that they would assist the Committee in every way they could in making their arrangements for taking coal from their line to the site on which the gas-works were proposed to be built. The Company agreed that, as far as their own land was concerned, they would put in the sidings at their own cost, and the Council would only be called upon to pay for sidings from the railway on to their land. He had already told the Council that they could not afford to wait, and that they must provide for the wants of the town. The making of gas was of such a nature, and the consumption increased so much, that two years hence it would be impossible to light the borough with their present powers. Many of the members had seen in the papers a great deal about the electric light, and had heard that it was possible it would, in some respects, supersede gas. He was of opinion that it would not interfere at all, or, if at all, to only a limited extent, with the consumption of gas in Warrington. The Committee went into that part of the question, and after consulting their Manager, and reckoning for the electric light being adopted for lighting large works and private establishments, they made a calculation as to the amount of gas consumed in the great works of the town. Their Manager said that the consumption of gas in Warrington in certain works was about one-tenth of the total consumption, so that practically, if they were to take the average increase of consumption of gas in Warrington, they would see that the one-tenth in question would very quickly be made up by the annual increase. It would be two years before they could complete their plans and manufacture gas on the site in question, in such a quantity as would meet the requirements of the borough, so that they were forced to make some arrangements to increase the works. Many opinions had been expressed in the papers about the electric light. Some were in favour of it, and others were not; but he did not think the electric light had been brought to such perfection as to deter the Committee going on with their work in lighting the borough with gas. They had made certain arrangements—and he thought they were very reasonable—with Colonel Blackburne, and if it should happen that, under the most unfavourable circumstances as far as gas-making was concerned, the piece of land in question was not required for the purpose for which it had been bought, he presumed, judging from the price and its situation, that the Corporation would not lose anything. They might, therefore, rest easy in that respect. Even when their arrangements were made, they did not propose to go to the extent of spending a large sum of money. In the first instance, they only proposed to increase the manufacture of gas as the town required it, and, consequently, the money would only be expended in such a way as to bring in a revenue for the amount spent each year. Mr. Paterson was not well, or he would have been present to answer any questions put to him on the subject; but in a letter he had written to him (Alderman Hepherd), he said, "I sincerely hope that no opposition will be interposed to the Gas Committee's resolution, so far, at least, as the purchase of the land is concerned, which, in my opinion, will be a good investment for the Corporation, under any aspect it can be looked at. As yet, and probably for a long period, gas has nothing to fear in its competition with any other method of artificial lighting, and I will carefully mature my plans until the present scare with the electric light shall have run its course." He (Alderman Hepherd) trusted that the minutes which had been read would be confirmed, and that the Committee would not be trammelled, if he might be allowed to use the word, with any opposition to their scheme, inasmuch as he believed that, for the general good of the borough, it was absolutely necessary that their operations should be carried out. There was another matter to which he wished to refer, and that was that the Committee proposed, when they had completed these arrangements, to manufacture their own products. Other gas companies made a large profit in that way, and they saw no reason why they should not do so. He believed from the price obtained for the ammoniacal liquor and tar they would ultimately make a profit of at least £1000 a year.

Mr. MILNER seconded the resolution, and read the opinion expressed by Dr. Siemens, in a letter to *The Times*, upon the electric light, in which he said he thought its application would be limited to the illumination of large buildings, harbours, coasts, quays, &c. He (Mr. Milner) thought it very necessary that the Committee should go on with the proposed extension, and believed that gas would in the future be greatly used for steam-raising purposes, heating, cooking, &c.

Mr. J. HARRISON said he was very sorry to place himself in antagonism to Alderman Hepherd, but he felt rather surprised that he should have been the one to move the resolution he had done in the face of all that was going on around them. When a man asked a body of men to do a thing, he was supposed to make out a case. Had Alderman Hepherd made out a case to justify the Council in purchasing 16 acres of land on which to erect works for the production of a light that was as surely doomed to be replaced by the electric light as he was then addressing them? When the electric light was mentioned, hardly a smile pervaded the countenances of any one present, whereas 18 months ago the mention of the name almost produced convulsions of laughter. Any one who then expressed his opinion that the light might ultimately take the place of gas, caused uproarious laughter; but now the mention of the thing was received with the utmost gravity, not a smile being seen anywhere. Alderman Hepherd had asked them to vote for the purchase of the land, and he told them what it was for; but he was sorry to say that no reasons had been given, except of the vaguest possible character, why they should take the course suggested. Mr. R. P. Spice said in his report, which was not very much more than 18 months old, that the present gas-works were more than equal to the necessities. That was to say, that they could produce considerably more gas than was necessary; yet in two years at the most they were called upon to make a material extension of the works. The Gas Bill only received the Royal Assent in June, 1877, and it seemed a remarkable oversight that, a year and a half or two years ago, some provision was not introduced into the Bill for meeting the difficulty, which one would have thought would have been foreseen—namely, that the works were too small for the requirements of the town. When they came to consider that the Gas Bill cost over £2000, it did furnish some reason why the matter should have been considered, and also why the Council should hesitate before plunging into such a large expenditure, which, in his opinion, was for such a doubtful advantage. Could any man shut his eyes to the fact that the electric light had recently made wonderful progress? The office of *The Times* newspaper was at this moment illuminated with the electric light; and the numerous hands employed there were now working by it, although they had just heard that it was so improbable that it could have general adaptation. There were numerous places in Paris which were likewise illuminated by the light. The Liverpool Corporation were taking the initiatory steps for the purpose of lighting the town with it; and some manufacturers in Warrington had that day told him that they were taking steps for the purpose of dispensing with the use of gas. They also said that they had engine power running to waste, and had only to get the necessary machine for the purpose to make their own electric light, and from the evidence they had from other sources there was no doubt it would be an immense advantage to them. If the electric light were introduced, the first customers the Council would lose would be the manufacturers. He found that the largest manufacturers in Warrington paid upwards of £1200 a year for gas. Was it to be believed that establishments already possessing engine power would go on paying upwards of £1200 a year for gas? If the manufacturers adopted the electric light, a great portion of the revenue of the gas-works would be lost. Alderman Hepherd had stated that large consumers only used about one-tenth of the produce, but he thought there was an inconsistency in that statement. The gross revenue of the gas-works for 1877 was £25,884. The large consumers of Warrington paid nearly £10,000 a year for gas, therefore the gross revenue should be nearly £70,000 instead of £25,884. There was another remarkable circumstance. The gross revenue for 1876 was £25,073, in 1877 it was £25,884, and for the half year ending June, 1878, it was £12,732. Assuming that the December half year was about the same—and there was not often much difference—he made it out that the gross revenue for 1878 would be about £400 less than that for 1877. Surely this was not an argument in favour of the extension of the works. He was not surprised at this diminution when he considered the extremely depressed condition of trade. He was afraid they had not arrived at the worst of it, therefore it did not appear to him to be a time to extend the works; and remembering what the electric light was sure to accomplish, the Council should hesitate before confirming the minutes of the Committee. Assuming that the electric light was generally adopted, they would have an abundance of room in their present works for making it. There was enough accommodation in Bank Street to do that, because the production of the light did not require much space, and therefore it seemed to be quite undesirable to purchase the 16 acres of land for the purpose of erecting works to produce a light which was inevitably doomed. He moved as an amendment—"That the minutes of the Gas Committee do pass, with the exception of that portion referring to the purchase of land at Longford."

Mr. BARLOW seconded the amendment, and thought that the mover of it had made out a good case. On the question of the practicability of the electric light, Mr. Milner had produced evidence on one side, but he had the authority of twenty persons on the other side, whom he could quote if necessary. There were, he observed, about 800 empty houses in Warrington, and from the information he had, he believed there was a probability that they would have one or two manufactories closing within the next six months, or at any rate manufactories which were now comparatively busy would not be wanting light at night time. He considered, therefore, that the extension of the gas-works was not requisite. He believed that if the works were put in the market now, the Corporation would not get as much as they paid for them by at least £50,000.

Mr. LEA opposed the motion, and read a number of extracts from reports and speeches made by the promoters during the time the purchase of the works was advocated, which tended to make the ratepayers believe that they were large enough to supply the wants of the town for several years to come.

Mr. CROSFIELD said he took a small part in the opposition to the purchase of the works, and he should like to state that what he did at that time he did conscientiously, and from a belief that he was doing right. He thought that now the ratepayers of Warrington would begin to believe that the gentlemen who opposed the purchase of the gas-works were pretty well justified in doing so. Where was all the increased consumption of gas they were told of? Everybody in Lancashire knew what the present state of trade was. It was now such as no man living knew before, and they had an awful and a black future before them. As to the increase of Warrington, he did not believe in it for a moment. They would yet see works shut up; they would see more houses empty in the town; there

would be privation all around them, and these things did not tend to increased consumption of gas. He did not like to interfere between the Committee and the Council, but, considering the rapid strides the electric light had made, he thought it would be as well for the Gas Committee to think very seriously before they proceeded further. He thought that at all events they should defer the extension of the works for a short time. The Metropolitan Board of Works were about to try an experiment on a large scale by lighting up the Thames Embankment, and that would probably give the verdict which all the world was waiting for. At present the obstacle to the adoption of the electric light was its cost; and scientific men were devoting their energies to the subject, and there was no doubt they would ultimately find a way of lessening the cost of production. How long that would take none of them knew. He did not believe himself that they would see it in dwelling-houses for five years; but he thought they would see the large workshops and streets in Warrington lighted by it within a year or two.

Mr. SUTTON said he should vote in favour of the minutes, for the simple reason that, as they had purchased the gas-works, they must make the best of them, whether the works turned out a profitable or an unprofitable investment for the ratepayers.

Mr. BROADBENT said that, whilst giving credit to the opposition for the excellence of their arguments, he was not inclined to agree with them, and considered the Committee had given very good reasons why the minutes should be adopted.

Alderman WEBSTER said the arguments and quotations used by Mr. Lea and others tended to prove the position of the Gas Committee, and he certainly denied that the gentlemen who had advocated the purchase had in any way deceived the ratepayers. He himself was certainly in favour of the proposed extension.

Alderman HOLMES said a number of gentlemen had expressed a desire that the matter should be deferred a short time, but if that was done the Council would not be able to apply to Parliament for twelve months, as the notices had to be published before the 30th of November.

Alderman BURGESS thought the necessities of the case justified the Committee in coming before the Corporation. The question was, should they expend £1000 in making application to Parliament for power to carry out the work, or should they take the great responsibility of having the town insufficiently lighted? That appeared to him to be the position, and he should vote for the confirmation of the minutes.

Mr. PLATT thought it would be a good thing for the Corporation to investigate the electric light for themselves, and, instead of spending £2000 in going to Parliament, spend a portion of it in lighting some of the streets with electric light.

The amendment was put and lost by 21 votes to 6; and the minutes were declared carried.

Alderman HEPHERD then moved the adoption of the following resolutions, of which he had given notice:—1. "That 16 acres of land, at Longford, on the east side of, and adjoining the line of the London and North-Western Railway, and on the north side of, and adjoining land of the Longford Wire, Iron, and Steel Company, Limited, and land of Colonel J. Ireland Blackburne, M.P., be purchased from the said Colonel John Ireland Blackburne, and that additional works be erected thereon for increasing the supply of gas and other light." 2. "That an application be made to Parliament in the ensuing session for a Bill to enable the Mayor, Aldermen, and Burgesses of the borough of Warrington to purchase the said land, and to manufacture, contract for, and sell gas, and the electric and other light, and for other purposes relating thereto." 3. "And that the Town Clerk be instructed to take all the necessary steps to promote such Bill in Parliament to carry out the said objects or such of them as may be deemed expedient." He said the Committee would take care to put every provision in the Bill to meet the electric light in case it was a success.

Alderman SMITH seconded the adoption of the resolutions, which, after some further conversation, were carried by 21 votes to 6.

DERBY WATER-WORKS COMPANY.

A Special Meeting of this Company was held on Monday, the 4th inst.—Mr. G. GASCOYNE in the chair—for the purpose of considering a proposal to make a further call of £5 per share upon the new ordinary £25 shares, and of £2 10s. per share upon the new ordinary £12 10s. shares, in order to pay off an amount of £17,000 owing to the bank.

The CHAIRMAN moved—"That the fourth call of £5 per share upon the new ordinary £25 shares, and £2 10s. per share on the new ordinary £12 10s. shares of 1875, be made, to take effect on the 1st of January next." He said that the last payment on account of capital for works which were now practically finished had been drawn from the bank, and as the Auditors suggested that the amount should be cleared off rather than be allowed to remain any longer at interest, the Directors proposed to make a call on the shares about sufficient to meet what was owing. He thought there was about £17,000 owing to the bank, and the amount of the proposed call would be £16,000. Inasmuch as there were no means of raising money except in this way, because the shares were all allotted, he did not intend to enter into the subject, or make any remarks further than merely moving the resolution. The necessity of paying the amount was not absolutely urgent, because their bankers had always acted with great liberality, and the proposition did not arise from them, but was a suggestion of the Auditors, who thought that the amount ought to be paid. The difference would be that, instead of paying 4 per cent. charged by the bank, they would have to pay dividends to the amount that the finances of the Company would allow. No part of the dividend on the new calls would come upon the current half year's dividends, but would take effect at the end of the following half year. Inasmuch as the Auditors felt it their duty to suggest that the amount should be paid, the Directors considered it their duty to comply with the suggestion, and, therefore, he asked the meeting to accept the resolution which he had moved.

Mr. HUISH seconded the resolution.

Alderman LEECH said he had formed the opinion that this resolution should not be agreed to, and he would explain his reasons, though this would involve the necessity of going into details. The proposition was to call up £16,000 additional capital, which the Company had power to do. This sum was a portion of £80,000, and would leave a balance of £24,000. When that £24,000 had been called up, the Company would have exhausted all their borrowing powers. They owed their bankers £16,000 or £17,000. Their experience of bankers taught them that they were the most liberal-minded people in the world, and so long as they could get good security they were delighted to have them on the debit side of the account. But why, at a time like this, should the Company positively increase their expenditure by at least £350 a year, which was the difference between the 7 per cent. they would have to pay to the Shareholders and the per centage they were paying to the bank? Apart from the question of absolute annual loss that would be thus created, there was another reason why it was not expedient to take the course proposed. He wished to say that he did not think it had been in human power to carry on the Company's difficult and exceptional business better than it had been carried on; but he asked to be forgiven for saying that circumstances had been against the Directors. Times had been against them, and times were coming when they would be abolished altogether. Let them see how they stood. He said they had exhausted their borrowing powers, and beyond a surplus of £24,000, after this £16,000, they would have nothing left. What had they been doing? In 1869 their maximum dividends were 10 per cent. on the old, and 7 per cent. on the new shares. From 1869 to 1876, or a period of 7½ years, they paid maximum dividends of 10 per cent. and 7 per cent., without a single break. They had occasionally a slight deficiency, but in other years they had a slight surplus, and were thus enabled to pay equal dividends, and business went on evenly and prosperously. At that time there was a contingent or reserve fund created. He had been at a loss to discover that it was created, as such funds generally were, from excess of profit, or surplus over and above the amount required for payment of dividends. He found that the fund arose from the premiums realized from the sale of new shares. The Company could not go on creating new shares for ever, and so the time would come when the dividends, instead of being 10 per cent. per annum, would be 5 and 3 per cent., and even less than that. If they could not get a contingent-fund by the legitimate mode of setting aside the excess over and above ordinary expenditure, they could not go on constantly creating new capital, selling the shares at a premium, and putting the premiums to the contingent-fund. As a rule, that was what the contingent-fund had been. It was created some time in 1876, and it was created principally, if not wholly, in the manner he had referred to—by the premiums realized by the sale of new stock. He took it that the contingent-fund was now exhausted. In June, 1876, they had a deficiency of over £1000, and the next half year there was a deficiency of nearly £2000. In June, 1877, there was a deficiency of £1782 19s. 8d., and in December, 1877, there was a further deficiency of £1233 2s. 1d. The Chairman, who, of course, used the language of the Directors, in bringing forward the report at a meeting held in September, 1877, and which had reference to the June accounts, stated that the reserve-fund amounted to £1999 6s. 7d. That was correct; and the Directors recommended the appropriation of £1782 out of the reserve-fund towards the payment of dividends of 8 per cent. on the original shares and 7 per cent. on the new shares, leaving the reserve-fund at £216 11s. 1d. But at the next meeting, in February, 1878, the Chairman said the Directors had taken £1161 2s. 8d. from the reserve-fund to augment the dividends of 8 and 7 per cent., to which amount, at this time, they had lowered the dividends. But they could not pay even that without a constant resort to the contingent-fund, and they appealed to that fund for £1782 out of £1999, and this left the reserve-fund about £216. The next half year the Chairman announced that they had taken £1161 2s. 8d. from the reserve-fund to enable the Directors to pay the same dividends as before—namely, 8 and 7 per cent. Where did the £945 11s. 7d. come from, when it was said that there was only £216 left in the fund at the previous half-yearly meeting? He knew no means, whereby the manipulation of figures between the two periods could be justified, by which the contingent-fund was increased from £216 to £1161 2s. 8d. The Chairman, of course, did not pretend to say that £1161 came out of £216; but where did the additional £945 11s. 7d. come from? This reserve-fund had been a most valuable fund to the Shareholders. Although created in the manner he had referred to, he found that no less than £7367 had been taken from it at various times since 1873, for the purpose of keeping up the dividends to the maximum of 10 and 7 per cent.; but smaller dividends had for the last few years been declared, and each time the deficiency had been greater by hundreds of pounds than ever before. The fund was created in an exceptional form, and if the affairs of the Company were brought before him for his opinion, he should have to come to the conclusion that the accounts needed to be overhauled and put on a new basis, or else their affairs must be wound up. This led him to another important point, and but for that he might not have been present at the meeting. He was a member of the Corporation, and took active steps in the management of affairs. No doubt the Shareholders were aware that the Town Council, by unanimous resolution of 51 members, determined to buy the water-works, and there was no doubt whatever that they would do it. The water-works were bound to be taken over, and he wanted to show that they were wrong in carrying a resolution into effect which would only be involving their affairs, and making them appear worse than they really were. He was a Shareholder himself, and he regarded it as being of the utmost importance that he should get the best possible dividend and the best possible security. He had said that the works would be taken over, and undoubtedly they would, and it would be an excellent thing. He advised the Directors to take the matter into full consideration, and if they had any difficulty, let them call in a few Shareholders to assist them in considering that momentous question, and let the Shareholders endeavour (and he said it as an Alderman of the borough) to obtain the largest amount of purchase-money which was consistent with the value of their property. If they went before the Legislature they would get the maximum value of their property. Parliament would not allow their vested interests to be interfered with without a *quid pro quo*. Let the Legislature see what those interests were, and let the case be put before them in a proper manner, so that the Shareholders might have justice done to them. He then alluded to the fact of the Scarborough Water-Works having been taken over by the Corporation, and he said that in the preamble of the Bill there was a strong declaration by Parliament in favour of such undertakings being in the hands of the Local Authorities. It declared generally that where a place was growing in importance it was essential for the true management of the whole matter—it was essential for the consumers—that the water-works should be in the hands of the Local Authority. He would show the advantageous terms upon which the works would be taken over, and that they would be taken over, he repeated, there was no doubt. At Scarborough, the Shareholders were granted the maximum dividends, to be paid in annuities; that was, each Shareholder received a warrant which enabled him to draw in perpetuity the maximum amount of dividend that by Act of Parliament he could receive. What security did the Shareholders get? Supposing that a reservoir should burst—he hoped it would not, but many casualties might occur to their machinery and works, but when the undertaking was vested in the hands of the Corporation, the Shareholders would suffer no loss, because their security was the borough fund, which was created by the rating of the borough. What could be better than that? Why, they had nothing to lose but everything to gain. The rateable property of the town would be liable to pay the annuities, except where the Local Government Board stepped in, which, no doubt, they would do in the Derby Act. In that case power was given to extinguish the annuities, by purchase, in 60 or 80 years—a purchase of 25 or 30 years—25 he believed it was. What was the reason why the works should be purchased? It was because people were beginning to think that water should be drunk as free as the air they breathed, and that there ought not to intervene against the consumer of pure water the shareholders or promoters of any water company who were making a profit out of the undertaking. He hoped these remarks would not be considered out of place, and he asked the Directors to stay their hands, and not make the call proposed. The Chairman had said that it was not pressing upon them; then do not let them complicate matters by taking such a step as that. He earnestly urged the Directors to take the opportunity of discussing the question he had brought before them,

calmly and dispassionately, and, if they liked, call in a body of the Shareholders to assist them. The undertaking was to be taken from them; let it be taken on the best possible terms. He had not endeavoured to deteriorate the property; he wished to see it placed in its true position. He would say that the Chairman had always been candid in his observations. It was no use attempting to disguise anything or to conceal anything, for the true position of the Company's affairs would be fully investigated in the course of the parliamentary proceedings he had mentioned. Let it be done with a good grace; and he said, lawyer though he was, Do not spend money on useless law. It would be simply taking money from the Shareholders for the purpose of opposing the Corporation, for they might depend upon it, they would find, at the end of the first day of the parliamentary proceedings, that resistance was utterly hopeless. Therefore he asked the Directors to stop in the path they were choosing. Do not let them look upon the matter as a want of confidence. He would not move an amendment, but he would ask them to look the matter broadly in the face, to defer taking action upon this particular point, in order that they might meet the Corporation with less difficulty, and that they might go before that body with a clean bill of health, and get the largest amount of money that they were justly entitled to receive. The Corporation would be successful, but their success would be as nothing compared to the benefits which must undoubtedly accrue, both in a pecuniary sense and in the shape of security, to the Shareholders of the Company. Those were the reasons why he was opposed to the resolution.

Mr. J. HUISH said he must confess that, to his mind, Mr. Leech had failed to produce any arguments that would bear against the Chairman's motion. It was not a matter of feeling—it was a matter of necessity. The Accountant and Auditor of the Company had thought it a right thing that they should have money called up, and they should not borrow any longer from their bankers. They had been compelled to draw on the reserve-fund, but did the Shareholders find any fault with that? It was formed for the purpose of meeting deficiencies. Did any Shareholder find fault with them for keeping up the Company and preserving it intact, and not allowing it to be taken from them till sufficient reason for so doing had been shown before Parliament? Mr. Leech's arguments might be used before a Committee of the House of Commons, but they were nothing to the resolution which was before them, and they would only have weight with members of the Corporation.

Alderman BARBER confessed that he did not see the advantage of opposing the resolution. The Shareholders were in a position in which they ought not to be. He agreed with Mr. Leech that their house ought to be set in order, and the way to do this was to pass the resolution. Mr. Leech had asked them not to pay 7 when they need only pay 4 per cent., but he premised that the interest was calculated according to the custom of all banks—namely, in half-yearly rests. They would thus find that what they paid was something very different indeed. He did not know how long the amount had rested, but, if long, he thought that their 4 would be nearly 7 per cent. He was one of those who thought that no dividend ought to be paid except out of the profits earned; but as to the legality of taking money out of the contingent-fund in the manner stated, he thought the power had been established by two successive decisions. Mr. Leech had spoken of negotiations for the Company being taken over by the Corporation by virtue of an Act of Parliament. He failed to see how the resolution interfered with that step, or how it would prevent the Shareholders, if they were so minded, from negotiating with the Corporation. Mr. Leech had placed before them many statements worthy of serious consideration, but still he thought their debts should be paid, and it was the duty of the Shareholders to see that the resolution was passed. They would be placed in a better position altogether by agreeing to the motion.

The CHAIRMAN said the gist of Mr. Leech's remarks had been one tirade against the prospective opposition of the Company to the proposed Corporation purchase of the works. His arguments were not addressed to the resolution at all; they were those of an advocate endeavouring to make out a case for the Corporation. He declared over and over again that there would be no doubt the Corporation would take the works from them. He said, "Look at Scarborough;" but he did not say, "Look at Nottingham." He had simply endeavoured to get publicity for the case of the Corporation, he being the most active member of that body as against the Company, and one who had shown towards them the most active feeling of antagonism. He had declared over and over again that the Company's case was hopeless. The Directors intended, however, to be the best judges of that. It certainly would not be taken over by a conference between the Directors and Mr. Leech, but only, if at all, in the proper course, after arguments and statements in the proper place. Had it not been for the Derby Corporation, the Company would never have had to face the resolution, for the conduct of the Corporation caused a wasteful expenditure of £25,000. More than £25,000 was expended by the Company through the opposition of the Corporation, not only in parliamentary costs, but in the enormous outlay for labour and materials which this opposition entailed. They threw back their labour and work into troublesome days, when they had to make a much greater outlay. Therefore the Corporation had created the difficulties to which Mr. Leech had alluded. As to all this, it would be for them to show it elsewhere. He was thoroughly satisfied that no justice, satisfactory to the Shareholders, could be obtained there; but that it was the duty of Directors, as it was their wish, that all arguments should be well ventilated, as well as they could be, in another place, where they would be far more efficacious, and the arguments of the Corporation better combatted than there. No one had said that there would not be a meeting of Shareholders called to look into their position and to inspect matters and see just how they stood. No one had made such a proposition, and no one had said "No" to it. All he had said was that it was necessary that they should pay their debts, and that they could not do so unless they had this £16,000 to do it with. When he said it was not imperative, of course he referred to the question of the bank simply; there was no imperative demand from the bank to pay them back, but the suggestion was made by the Auditors, and, therefore, it almost amounted to a command. The Directors were not ashamed of the accounts, and they had been arranged by as good accountants as any in England. A copy of the accounts was delivered to the Town Clerk, and the Shareholders could come at given times and inspect the books. How was it that Mr. Leech had left it till the last moment before he came there with those arguments? The fact was that the Corporation knew that the present was the hour of their emergency; they knew that the Company required time to recoup themselves for this great outlay, but they would not let them have the time. He (the Chairman) was the creature of the Board, so far as he was himself concerned, and he was determined to do his duty. If the Shareholders called on him to resign, he should do so, and they could, if they were so disposed, take it out of his hands, and entrust it to Mr. Leech and the Corporation. He knew where they would be landed very soon. Men who had laboured all their lives in different works, and invested their savings in the Company, would certainly be able to see through this shallow device. Let them keep their own counsel; they were bound together by a grand fraternity, and nothing of this kind ever passed before, and he hoped now that it would not be allowed to succeed. But he did not want to go into details; it would be very easy for Mr. Leech, with his legal acumen and experience, to fish out certain things, of which an after use might, perhaps, be made. Words were sometimes made to bear meanings that their utterers never intended.

Mr. J. N. HEFFORD, as an old Shareholder, reminded the meeting of the way in which the Company were started, and the small dividends that at first accrued. They had extended the supply to Normanton and outlying districts, and they had not as yet received a return for their outlay. It was a well-known fact that there was no better water in any town in England than at Derby.

Mr. BEMROSE said he had hoped that the Chairman would have given some explanation of the creation from half year to half year of the suspense-account. He was there as a Shareholder to a small extent, and as a Member of the Corporation. The action of the Corporation in no way reflected upon the management of the Company; but they were taking the subject up to keep pace with the times, and the public feeling that a concern like this should be handed over to the Sanitary Authority. The Corporation were compelled to take the necessary legal steps for acquiring the works of the Company. He assured the Directors they had no desire to reflect on their past management, but he wished to treat the matter as a commercial transaction, in which the Shareholders should have full and proper value for the undertaking.

After some further discussion, the motion was put and carried by 27 votes to 3.

A vote of thanks to the Chairman, moved by Mr. BAKER and seconded by Alderman LEECH, terminated the meeting.

THE PROPOSED EXTENSION OF THE BARNSLEY CORPORATION WATER-WORKS.

A Special Meeting of the Barnsley Town Council was held on Thursday, the 31st ult.—the MAYOR (Mr. B. Marshal) presiding—for the purpose of passing a resolution to enable the Corporation to extend the water-works and water supply, in accordance with a recommendation contained in a report submitted by Mr. Thomas Hawksley, the Water-Works Engineer of the Corporation.

Alderman CARTER moved—"That the Council apply to Parliament, during the ensuing session, for further and additional powers, rights, and privileges, in reference to a better supply of water, and for obtaining an increased watershed; and powers, rights and privileges to construct additional reservoirs, conduits and other works, and raise more money; and to extend the limits of supply; and to pay the costs, charges, and expenses preliminary and incidental to promoting the said application out of the general district rate of the said Borough of Barnsley." He said that the object he had in view was that the Council should apply to Parliament for power to extend the water-works, and give the town and neighbourhood that supply of water which they would be unable to give unless they were enlarged. A million and a quarter gallons of water per day was not much to rely upon for a town like Barnsley, increasing as it had done. They would either have to extend the water-works, or put a stop to the growth of the town and neighbourhood. With respect to Barnsley, the ratepayers were not only able but willing to pay whatever was necessary. He might remind the Council that during the last few years they had been blessed with an abundant supply of water, and they had only known one year when a scarcity stared them in the face, and that was five or six years ago. The present year was one which had not been exceeded for rain for some years except in 1874, and the result was that the reservoir had been full all the summer. The position was one which would admit of no answer, whether they were startled into it or not, that the first dry season that came they would find that the water supply was not enough to meet such a demand as they had upon them.

Alderman TYAS, in seconding the resolution, pointed out that it was a question for the consideration of the Ratepayers as well as the Council. He assured the Council that the Committee had given the subject their serious attention, and he was not in the habit of opposing the decisions of a Committee unless he had special reasons for doing so. He also referred to Mr. Hawksley's report, which stated that if the town went on increasing in population at the same rate as it had done during the past four or five years, the people would be without a sufficient supply of water. If that were true, he (Mr. Tyas) thought it behoved them as a body to at once take steps to meet such a serious emergency.

Mr. KAYE said that Mr. Hawksley had stated that the population had increased 25 per cent. in ten years. On looking into the matter, he found that their present supply of water would satisfy them for 40 years to come. It was well known that a large amount of water was wasted, and he had been told about a month ago that there was a stream of water running down from the reservoir at Old Town from eleven o'clock at night until the next day, and there would be as much as would fill a 4-in. pipe.

Alderman PIGOTT said after they had heard the report of Mr. Hawksley he had no doubt they had made up their minds as to the course they should take. The question was brought before the Water-Works Committee when they heard that Penistone was going to make a watershed below Scout Dam, just below their watershed, and were going to lay out from £15,000 to £20,000 upon it.

Mr. JACKSON said if Alderman Carter would alter his resolution so that the proposition should go before the ratepayers first, he would support it; if not, he must vote against it.

In answer to Alderman Tyas, the TOWN CLERK intimated that it was necessary to move the resolution, in order to place the matter before the ratepayers.

The MAYOR reminded the Council that if they passed the resolution they would be pledged to go to Parliament. So far as he could see, they were under a contract to supply the out-townships, but they were under no obligation, other than they were, to have water when the town had it to spare. If they went in for a gigantic scheme, at a cost of £300,000, it would be a burden upon Barnsley for the purpose of supplying the out-townships. He also pointed out that Mr. Hawksley, some time ago, stated that they could save a considerable quantity of water by placing iron planks at the reservoir, and raising the area of the water. They could also save a large amount by preventing a waste of water which was now going on; and, if the worst came to the worst, they had the River Dearne to fall back upon, and he felt sure there would not be the least danger in the inhabitants being supplied with one-sixth of their water from that source.

After some further discussion, the motion was put and lost by a majority of 10 votes to 6. The result is that the water-works extension scheme is shelved for the present.

SCRAPING A WATER-MAIN.

At a recent Meeting of the Lancaster Urban Sanitary Authority, Mr. W. ROPER (the Deputy-Chairman of the Water Committee) submitted the following report upon the Scraping of an 8-inch Main, laid in 1854:—

Owing to the difficulty in obtaining the usual quantity of water, and the continuous decrease in the discharge of the main, attributed by Mr. Mansergh, our Engineer (in his report, 1875), to the reduction of the sectional area of the main, caused by incrustation, the Authority, acting upon his

advice, authorized the purchase of apparatus suitable for cleaning the pipes.

The first trial was made on the 1st of August, from Brow Top basin to the River Conder, where there are duplicate mains—a distance of about 1760 yards. A door-pipe was placed in the main, a short distance below the Brow Top basin, in order to obtain a head of water equal to 20 feet to commence with. Another door-pipe was placed in the main near Conder Bridge, the difference in level between these points being about 360 feet. Upon turning on the water at Brow Top the scraper started with a low rumbling noise, travelling at the rate of about six miles an hour for a distance of nearly 1300 yards, when it was stopped by the lower portion of a valve which projected into the main. After the removal of this obstruction the scraper continued its course at about the same rate as before, propelling in front of it, and sending out of the lower door-pipe, huge quantities of scale and peaty substance.

The result being so successful, the Committee were engaged to clean another length—namely, the single line of pipes (also laid in 1854) between the High Cross Moor reservoir and the Appletree basin, the distance being about 1500 yards, and the difference in level 220 feet. Two door-pipes were fixed in this length, one about 50 yards below the High Cross Moor reservoir, to obtain the necessary working head at starting, the other a few yards from the Appletree basin.

In preparing the door-pipe at Appletree basin, a portion of the main-pipe was removed, the inside diameter of which was found to be reduced from 8 inches to 6½ inches, by incrustation and adhesion of peaty and other substances to the inside of the pipe.

On the 23rd of August, 1878, this length was cleaned by sending the scraper twice through the pipe. The result was perfectly successful, and the discharge of the pipe restored to its normal quantity. By an experiment tried that night, it was found that the increased delivery of the main amounted to 56·51 per cent.

The estimated cost of the apparatus, and all expenses incurred in preparing the main for scraping from the service or workhouse reservoir to the Gauge basin or High Cross Moor reservoir, a distance of 7740 yards, or about 4¼ miles, was:—Eight door-pipes or hatch-boxes, £44; cost of fixing hatch-boxes, £28 4s.; scraper, £13 10s.—total, £85 14s., or equal to about £19 10s. per mile. This is perhaps a larger expenditure than is requisite in some works, owing to the frequency of basins of equilibrium, causing an outlay upon extra door-pipes. The scraping should be repeated every third year; the time occupied would not exceed two days, and employ four men: say, interest and wear and tear on outlay, £85 10s., at 10 per cent., £8 11s. 5d.; £8 11s. 5d. multiplied by three, equals £25 14s. 3d.; labour, £2—total, £27 14s. 3d., or an annual expenditure equal to £9 4s. 9d. to keep clean a main of 8 inches diameter and 7740 yards length, or two guineas per mile.

The total outlay and cost of cleaning the main from the River Conder to Brow Top basin, 1760 yards, and from Appletree basin to Gauge basin reservoir, 1500 yards, say total 3260 yards, has been, for scraper, £13 10s.; five door-pipes, fixing, &c., £17—total, £30 10s.

As the scraper is available for the whole length of main, and will last many years, it will be unfair to say the cost of cleaning 3260 yards amounts to £30 10s.; the fairer plan would be to charge the £30 10s. to capital, which at 10 per cent. for interest and wear and tear would equal £3 1s., and with one day's labour once in three years at £1, or say £3 1s. multiplied by three years, £9 3s.; labour once in three years, £1—total, £10 3s., or equal to an annual outlay of £3 7s. 8d., or £1 16s. 6d. per mile per annum. The Committee would congratulate the Board upon the results obtained, which have exceeded their most sanguine expectations. The whole of the 8-inch main has not been cleaned, and, until the duplicate line of pipes by Damas have been laid, the Committee do not recommend the Board to complete the scraping.

Mr. Kennedy, the maker of the scraper, was present, and assisted on the first day. A very large amount of deposit was removed from the pipes, a small portion of which was submitted to our Medical Officer, Dr. Harker, whose report is appended:—

"The material is of a light spongy brown appearance, resembling ginger-bread in colour and consistency. As removed by the scraper from the water-pipes, the larger flakes measure ¾ inch in thickness. A small portion diffused in water, when examined by the microscope, is seen to consist of fine amorphous particles of a brown colour.

"Chemical examination: In 100 parts as follows:—

Water	64
Organic matter and water of composition, consisting chiefly of brown insoluble vegetable matter, common to all soils	23
Mineral matter after incineration	13
	100

"Of this mineral matter there was—Iron protoxide, 7; silica in minute crystals (silver sand), 2; alumina, 2; lime and other soil matters and loss, 2—total, 13.

"N.B.—The mean result of two examinations is given, as, by evaporation, the substance changes in density from day to day.

"Observations: The scrapings are therefore fine soil matters, deposited under high water pressure, and iron rust from the pipes."

SOCIÉTÉ TECHNIQUE DE L'INDUSTRIE DU GAZ EN FRANCE.

Prize Competition for 1879.

The Committee of the above Society announce that the following sums will be awarded in prizes at the Annual Meeting in 1879:—

1.—A sum of 4000 francs (£160), in prizes of various amounts, to the authors of the best papers on any subject connected with the gas industry. The number and value of the prizes will be determined according to the importance of the papers deemed worthy of the award.

2.—A sum of 1200 francs (£48) to be divided between the authors of the two best papers written for, and presented at, the Annual Meeting in 1879.

3.—A sum of 200 francs (£8) to be given to the foreman or workman recommended for the longest and best service in gas-works.

All persons, whether Frenchmen or foreigners, Members of the Société Technique or not, are eligible to compete for the prizes in the first group. Those in the second are restricted to Members of the Society. The qualifications of the competitors for the third prize must be indicated and certified by the Managers or Superintendents of the works in which the candidates are employed, and must be sent to the offices of the Society, 9, Rue de Provence, Paris, before April 1, 1879.

The papers must be unpublished productions, and written in French; they must each bear a motto, which must also be written upon a sealed envelope containing the name of the author. The papers, with the accompanying envelopes, must be sent to the offices of the Society, as above, before May 1, 1879. The prize papers will be published in the Society's Annual Report. The MSS. will not in any case be returned to the authors, but will become the property of the Society, and be deposited in their archives.

The prizes will be awarded by the General Committee upon the report of a commission of five members nominated by them, and the awards will be made in general meeting.

The following subjects are suggested by the General Committee as worthy the attention of competitors; any others, however, may be chosen:—

On the various Systems of Constructing Gasholders and Gasholder-Tanks.
Design for Model Gas-Works to produce 5000 to 10,000 cubic mètres (177,000 to 353,000 cubic feet) per Day.
The Economic Heating of Gas Ovens by means of Solid, Liquid, or Gaseous Combustibles.
Gas Manufacture in General, and the Apparatus employed therein.
The Mechanical Charging of Retorts.
The Construction and Working of Retort-Settings in Works of various Capacities.
Manufacture and Purification of Wood Gas.
A Simple Method of Ascertaining the Temperature of Retorts.
Method of Preventing Obstructions in Ascension-Pipes.
Method of Avoiding Obstructions caused by Naphthaline.
The Utilization of Waste Heat.
On the best Method of Purifying Gas from Sulphur, Ammonia, and Carbonic Acid.
On the Means to be adopted for Removing the Sulphur existing in Gas in other forms than Sulphuretted Hydrogen.
The Effect of Washing on Illuminating Power.
The Economic Revivification of Purifying Materials.
On the best Kinds of Condensers.
On the Treatment of Ammoniacal Liquor.
On the Direct Employment of Ammoniacal Liquor in Agriculture.
On the Manufacture of Sulphate and Carbonate of Ammonia
On the Compression of Breeze, and the Employment of the Combustible obtained thereby.
Industries, connected with Gas Manufacture, which would allow of the Utilization of Coke and Tar in Tropical Countries.
On the Means of Collecting, in the form of Ammonia, all the Nitrogen contained in Coal.
On the Utilization of Spent Purifying Materials.
On the Employment of Workmen by the Day or by the Piece.
On the best Means of Extending the Use of Gas for Lighting, Heating, and Supplying Motive Power.
On the Inconveniences of Municipal Gas-Works.
On the best Gas Heating Apparatus for Domestic or Industrial Purposes.
On the best Systems of Gas-Meters.
On Burner Regulators.
On the different Kinds of Photometers.
On the Determination of the Illuminating Power of Gas without the Aid of a Standard Light.
On the best Burners for Lighting Purposes.
On Laying Gas-Mains, and on the best Method of Discovering and Remedying Leakages.
On Regulating the Pressure in Mains.
On Loss of Pressure due to Friction in Pipes under Two Inches in Diameter.
On the best Means of Testing the Accuracy of Consumers Meters without Removing them.

The titles and a summary of the papers—or, wherever possible, the papers themselves—to be read at the Annual Meeting, should be sent to the Society's Offices at least one month before the date of the meeting, in order to facilitate the preparation of the programme of arrangements, and allow of its early despatch to the Members of the Society.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

(*Continued from p.* 640.)

Mr. Mitchell (Coatbridge): I have great pleasure in proposing that we accord to Mr. Stewart a hearty vote of thanks for the able address to which we have just listened. The President has taken up and dealt, in his usual vigorous manner, with several questions of very great interest to gas managers, not the least prominent of which is that of electric lighting. The subject is one which has interest to most of us, and it is one which deserves our serious consideration. I am sure you will agree with me in awarding to Mr. Stewart our best thanks.

NOTES ON SOME OF THE PHYSICO-CHEMICAL LAWS RELATING TO GAS.

Mr. William Young (Clippens), who was received with loud applause, said:

Since joining this Association, and coming into intimate contact with its members, I have been quite surprised, and at the same time much gratified, to observe the anxiety displayed by its members to become better acquainted not only with the merely mechanical details of their profession, but also to acquire a knowledge of the physical and chemical laws upon which their manufacturing process is based. And I am the more especially pleased to see this trait in the character of its members, as I am sure that it is only by the acquirement of such knowledge that the manufacture of gas can be brought to its utmost state of perfection, and able to compete with other modes of illumination. The old "rule of thumb" mode of manufacture will no longer be tolerated, and it will be those among us who have made the profession a science who will succeed in the battle of life.

During the past twelve months, partly on account of ill health, and partly from having extra duties to perform, I have not been able to do much practical experimenting on the manufacture of gas, and consequently have nothing of a very practical turn to bring before you to-day; but although the hands have not been able to work, the mind, somehow or other, has had time to think. Those thoughts I have noted down from time to time, and as they have a physico-chemical bearing upon your manufacture—more especially directed to the explanation of certain well-observed results from a reference to ascertained laws of nature—I thought, from what I have already indicated, that they might prove acceptable to the members of this Association.

I regret that I have been unable to extend these notes in writing, as I would have liked; but I shall do what I can, in an extempore manner, to render them intelligible.

Grafton, in his experiments relating to the causes of carbon deposit, states that he observed, what I have no doubt you have all, more or less, observed, that as the film of carbon on the internal surface of the retort gains in thickness, the more rapidly does it go on accumulating. You are all also aware that on new retorts there is a greater tendency to deposit of carbon than on old ones, and, if I remember aright, our worthy member, Mr. M'Gilchrist, of Dumbarton, has stated that he counteracts this tendency in new retorts by careful scraping of the internal surface, and that after a period of time the retort so regularly scraped gradually loses to a large extent the tendency to acquire a deposit of carbon. I can verify the last statement of Mr. M'Gilchrist, as I have frequently visited his works,

and paid particular attention to the state of his retorts. The question then arose in my mind: How do those results come about? At first I attributed them solely to the roughness of the surface of the new retorts, and to the increase of surface by the increased deposit of carbon as it accumulated in the retorts; but some experiments which I have made lately have convinced me that they were due to another cause. Those experiments I shall repeat to you to-day, and I hope they will at least point to a different cause, and lead some of our members, who are fortunate enough to have more time to spare than I have, to more fully investigate the subject.

Before proceeding, however, to make those experiments, permit me to allude to a letter from Mr. Joseph Tysoe, which appeared in the columns of the JOURNAL OF GAS LIGHTING some considerable time ago, in which he drew attention to the diffusion of gases, or, as he put it, the dialysis of gases, having the effect of causing the carbon to deposit on the surface of the retort. This, in so far as I am aware, was the first occasion upon which attention had been drawn to the diffusion of gases as affecting the deposit of carbon. At the date of this letter I was not of opinion that the diffusive action of gases was the cause, and expressed my opinion to that effect in a letter to the JOURNAL at that time. Now, however, I entertain a different opinion, for although the tendency of gaseous diffusion does not in all respects act in the manner indicated by Mr. Tysoe, yet I believe that the tendency of gases to diffuse through each other, combined with the condensing power of carbon on gases, is the principal cause of the results referred to.

I have here an arrangement to illustrate the diffusive action of gases through porous septa. It consists of a porous earthenware vessel, such as is used in the carbon voltaic battery of Bunsen. I shall ask you to suppose that this represents a gas-retort. You will observe that this cell is cemented into this basin, and that it has attached to it this glass tube about a yard in length, which dips into this jar of water, coloured to render visible its rise and fall in the tube.

By means of these two pipes I will fill the porous vessel with the coal gas supplied to this room. You will observe that the moment I cut off the supply by turning the taps on the outlet and inlet pipes, the coloured water in the glass tube rapidly rises, showing that there is a partial vacuum formed inside the porous cell. Now, how is this partial vacuum brought about? It is because the coal gases tend to diffuse through the air external to the porous vessel, and the air through the coal gases inside the porous vessel; but as the coal gases possess a higher diffusive rate—or, in other words, as the molecular motion of the coal gas is greater than that of the external air, the coal gas passes through the pores of the clay vessel more quickly than the air passes inward, the water rising in the tube to supply the difference in the rate. For a few minutes I shall again pass a current of coal gas through the retort or porous cell, but this time I shall keep it covered with this glass bell-jar. During the time the gas has been passing through the cell it has been diffusing through its pores into the space between the cell and the bell-jar, and at the same time the air in the space has been passing through the pores into the vessel. By now shutting off the current of gas you observe that the coloured water in the glass tube rises very slowly, and only to the extent of a few inches, and then slowly falls till it reaches the level of the water in the jar. This results from the fact that the gases outside and those inside the cell have a like composition, and that although the diffusion or passage of the gases through the pores of the cell is still going on, yet the rates at which they are passing are the same, and therefore there is no vacuum formed; but if I now slowly lift the glass bell-jar, and thereby remove the external atmosphere of coal gas, you see that the rate of the diffusion is disturbed, the coal gas passing outward from the cell much more quickly than the air does inward through the cell, the water in the tube rising rapidly to supply the deficiency. If I now lower the bell-jar, and thereby bring back the atmosphere of gas, which from its lower specific gravity to a certain extent remains behind in the bell-jar, the rate of diffusion is again altered, and the coloured water depressed, as the rate of diffusion inward is greater than that of the mixed gas and air outward.

Now, as you are aware, coal gas is a heterogeneous mixture of various gases, each of which diffuses at different rates; and further, the rate of diffusion of each of the gases or vapours is more or less modified by that of its neighbour; but, roughly speaking, each gas or vapour diffuses in a ratio dependent upon the square root of its density, the lightest having the highest diffusive rate.

The coal gas which we have been using has a specific gravity, in all likelihood, about half that of air; but hydrogen, even when saturated with moisture, has a specific gravity about 1-14th that of the air. I shall now repeat my experiments with the latter gas, upon which you will observe that all the former results are intensified.

After filling the cell with hydrogen gas, and suddenly cutting off the supply, you see how rapidly the coloured water rises in the tube—so rapidly, indeed, that it would go up into the porous cell and destroy its porosity, were I not to open this tap, and thereby allow a quantity of air to pass in, sufficient to make up the difference in the rate of diffusion of the hydrogen out through the pores of the cell to that of the air inward.

I will now repeat the experiment by covering the bell-jar. You observe that, after streaming the hydrogen through the cell for a minute, and then cutting off the supply, the water in the tube now rises comparatively slowly and only to a limited height, due to the atmosphere both outside and inside the cell having nearly the same specific gravity, and consequently similar molecular motions; but the moment I commence to lift the bell-jar, and thereby, so to speak, lift the hydrogen atmosphere from outside the cell, and allow access to the denser air, that moment the water rises in the tube, showing that the hydrogen in the cell diffuses outward more rapidly than does the air inward. By returning the bell-jar, and consequently the atmosphere of hydrogen, the coloured water sinks; and, by moving the bell-jar slowly off and on to the cell, the rate of diffusion is alternately altered, and the coloured water rises and sinks as if by magic.

Now, gentlemen, we have in these experiments been dealing with gases in the cold, and with a perfectly porous septum, and, although they may explain why new retorts gather carbon more quickly than old ones, they give no explanation of the other observed results—viz., that by allowing the carbon to go on accumulating, it grows the faster, and that by scraping the internal surface of the retort, the deposit is prevented.

The explanation of those results is to be found in the fact that, in the practical carbonization of coal, the gases and vapours do not pass as simple gases and vapours through the porous wall of the retort, but that they undergo decomposition, and thereby acquire new diffusive rates in their passage.

To illustrate: Let us take benzole as the hydrocarbon which we wish to follow in its passage through the wall of the retort. It will enter the wall of the retort on the inner side, as C_6H_6, and in all likelihood the portion reaching the other side will do so as nearly pure hydrogen, the carbon having been left behind; but the decomposition will be progressive the greater portion of the carbon being left behind on the inner surface. Thus two molecules of benzole enter as $C_{12}H_{12}$, but before they penetrate an inch in depth, they may be decomposed, stage by stage, into three molecules of marsh gas, 3 CH_4 = C_3H_{12}, leaving behind nine atoms of carbon; and, as the marsh gas has only a specific gravity of 0·559, its rate of diffusion will be much greater than that of benzole vapour, having a specific gravity of from 2·738, from which it was produced, and, therefore, a portion will have a tendency, from its higher molecular motion, or diffused rate, to return to the retort from which it came. The remaining half, say, passes outward, undergoing further decomposition, leaving the carbon behind, and becoming pure hydrogen. At the same time, a portion of the furnace gases will pass into the retort, the quantity being dependent upon the specific gravity—that is, supposing the wall of the retort is porous; but we know that in actual practice the walls of the retort do not long remain porous, because the furnace gases carry up with them portions of ash and the alkalies present in the ash, which form a flux on the surface of the retort, and, so to speak, glaze it and destroy its porosity. Supposing such should be the case, it does not follow, however, that the diffusion of the gases would cease, and that the carbon would stop being deposited, because the hydrogen which would be produced from the decomposition of the marsh gas in the external pores of the retort would, from its high diffusive rate or molecular motion, return to the retort from which it came.

Thus, we see, it is not necessary that the diffusion should extend through the wall of the porous vessel, as when both septa and gas are cold, but that when the decomposition takes place in the walls of the porous vessel, and the specific gravity of the gases is thereby altered, the diffusion may take place in the pores of the vessel itself.

I have here a diffusometer, formed of two porous cells and an external glass one, a thin concentric film or space being left between each. Connected to each space is a tube similar to that attached to the diffusometer already experimented with. By a suitable pipe I am able to supply the inner cells and spaces with such gases or vapours as would likely be present in the walls of the retort when heated, and when the products of distillation of the coal are undergoing distillation. By this arrangement, the diffusive action of the gases can be beautifully illustrated in the manner referred to; but the time necessary to perform the experiments is such as to prevent me from making them before you to-day.

The PRESIDENT: There is plenty of time, Mr. Young.

Mr. YOUNG: The rest of my paper will take up a considerable amount of time, and I am anxious to get through the whole of my notes, though it may be superficially. At some of our future meetings I propose, if I am able, to bring the matter forward in a more perfect form, when the members will be better able to discuss the question. My object just now is to give a cursory narration of what I have been thinking about, so that members may be able to experiment practically on the subject, and at a future meeting take up and discuss the matter. I may further state that my health has been by no means what it should have been, and I am even now suffering from headache, and therefore hope to be, at present at least, excused from making the experiments.

The PRESIDENT: I am sure we all sympathize with you; but it would be a great loss not to learn more on this interesting subject.

Mr. YOUNG: Perhaps I may be able to make it a little fuller in extending my notes for publication. In the meantime, returning from this digression, let us examine what would be the effect of scraping away the carbon from the inner surface of the clay as it is formed, or, at least, leaving as thin a film of carbon as possible on the internal surface of the retort; and, on the other hand, allowing the carbon to deposit at its own free will.

I have here two diffusometers, formed of discs of carbon attached by cement to glass tubes—the one from a retort in which the carbon has been allowed to collect freely, and the other from one where it has been kept thin by regular scraping. I will fill each of these diffusometers with hydrogen, and place them in their respective jars of coloured water. You will observe that the one formed of the carbon which has been regularly scraped shows no indication of the diffusion through it of the hydrogen, while the other allows the hydrogen to diffuse rapidly, shown by the coloured water rising rapidly in the tube. The reason of these results will, I have no doubt, have already suggested itself to your minds—viz., that by continual scraping of the surface of the carbon, it ultimately, from the carbon deposited within its pores, becomes so dense as to be non-porous, and perfectly impervious to the products of distillation; and, therefore, the only carbon deposited is that due to the contact of the gases on the highly-heated surface, and as that surface is smooth, the deposit is small; whereas, on the other hand, the newly-deposited carbon, when unscraped, is porous, and acts as an excellent diffusometer or atomalyzer. The gases and vapours enter its pores freely, there undergoing decomposition, carbon being deposited, and the liberated hydrogen, marsh gas, and other gases having a low specific gravity, returned into the retort. Porous carbon, as you are also aware, has the power of condensing vapours and gases with its pores; and as its unscraped surface is rough, it rapidly gathers fresh coatings of carbon.

From the foregoing, it will be readily understood how carbon can collect on iron retorts, it being only necessary that a thin film be deposited, which will be produced by the contact of the vapours of distillation with the highly heated iron. This will at once become an atomolyzer of the gases, and as the carbon gradually increases in thickness the more will the diffusion of gases come into play, and the more quickly will the carbon be deposited.

My next note bears upon the observed fact that light charges of coal give much better results, quantity and quality of gas considered, than heavy charges. For instance, a retort capable of containing 3 cwts. of coal at a charge gives, when charged with 2 cwts., better results than when charged with 3 cwts.; but where 2 cwts. of coal are charged into a retort capable of holding that quantity only, it does not give better results than the 3 cwts. charged into the 3 cwt. retort; but 1½ cwts. charged into the 2 cwt. retort give results equal to the 2 cwt. charge in the 3 cwt. retort; or, in other words, when coal is charged into a retort to completely fill it, not so good results are obtained as when the quantity of coal charged into the retort is such as to leave a considerable free space above it.

It has hitherto been supposed that those results were due to the increased surface in proportion to the smaller charge, as well as to the gas escaping more freely from the retort by reason of the space above the charge. There is no doubt that the results are in part due to these conditions, more particularly with English caking coal; but I do not think that they are wholly due to these conditions, for were these conditions the sole cause, then, with surface and charge proportionate to each other, whether a space were left or not, like results would be obtained when shales, parrots, and non-caking splints were used, where there is always ample space between the pieces for the escape of the gases from the retort to the stand-pipe. From practical experiment, I know that such is not the case. As large a yield may be obtained, but the quality is defective. Further, in the destructive distillation of shale for oil, we have another proof that the free space above the charge alters the nature of the distillation, for a horizontal retort, where there is a free space above the charge, gives 10 to 20 per cent. less oil than is got from a vertical retort, when the charge completely fills it, the volatile products finding their way from the retort through the spaces between the shale. The oil also, from the horizontal retort, has a much lower specific gravity, containing fewer of the higher solid paraffins, showing that the products of distillation have undergone a

different kind of distillation from that in the retort where the shale filled it completely.

From a recent study of some of Professor Tyndall's works, I have come to the conclusion that the results referred to are, to a large extent, due to the action of radiant heat.

But, before proceeding further in this matter it is, perhaps, necessary that I should make a few preliminary remarks upon the modern theory of heat, in so far as it has reference to my subject.

Heat, according to modern ideas, is a mode of motion—that is, it is a state of matter, not a substance. Just as sound is a state of motion of matter made sensible to us, as sound, through the motion having been communicated to the air in a series of pulsations or waves, and those waves striking upon the diaphragm of the ear; so is heat supposed to be a mode of motion of the molecules of matter, this motion being made sensible to us as radiant heat by the moving molecules communicating their motion to an ether which pervades all space.

The motion of matter which produces by radiation through the air the sense of sound, can also be felt. If the hand be laid on a large bell, whilst sounding, you feel the tremour or motion of the mass, or if I strike this tuning-fork, and cause it to vibrate, on bringing it cautiously into contact with any part of my skin, I feel that it is vibrating.

In a similar way, the molecular motion which, by radiation through the ether, produces the sense of heat, can also be felt, for on laying the hand on a heated mass of metal we experience the motion of the molecules as heat.

By this resemblance between sound and heat, I will now endeavour to convey to your minds how it is that radiant heat affects the carbonization of coal.

I have no doubt but most of you will have made the experiment of opening the cover of a piano, and singing into the wires. When you did so, you would find that, just as your voice rose and fell, certain of the wires would be set in motion; or, in other words, that the wires would respond to the voice. I propose to further illustrate this part of my subject by means of those tuning-forks; but the noise from the street is so great that it would completely drown the sound of the forks. However, after the meeting is past, you may experiment for yourselves, when by bringing them close to you, and sounding this fork, and presenting it to each of the other forks in succession, you will find that only one of these will respond and take up the sound.

Now, why is this the case? As I believe most of you are aware, when you sing to the piano you, by means of the larynx, mould the air as it passes from your lungs into a series of waves or pulsations, which, striking upon the strings, set in motion the wire, which would, from its length, vibrate synchronously with those pulsations.

In the same way the tuning-fork set in motion moulds the air into a series of waves, and it is only the tuning-fork of the set which can move synchronously with those waves which can respond.

I have here an ivory ball suspended by this piece of string. By a series of puffs from my mouth, timed to synchronize with the rate at which the suspended ball can oscillate as a pendulum, I gradually set it swinging, each puff augmenting its motion. If I now lengthen the string, and make a series of puffs at the same rate as before, the ball does not move, but remains stationary. Why? Because the rate at which the ball can swing, due to its weight and the length of the string, no longer synchronizes with the puffs; but if I slacken the rate of the puffs of air till they are timed with the swing of the ball, it at once begins to swing.

It is supposed that were heat absent from the earth the molecules of all matter would be stationary; but heat being present, all molecules are in motion. Now, like the wires of the piano, the tuning-fork, and the swinging ball, Tyndall has shown that the molecules of gases and vapours have different rates of motion peculiar to themselves, and can only respond to the waves of the other radiating from the molecules of a heated body which synchronize with their own rate of motion.

On gradually heating a platinum wire by sending a current of electricity through it, it is found that the first waves of ether radiating from it are the longest, and that as the heat gradually increases there are added shorter and shorter waves, till on the platinum attaining its point of fusion these waves are of a great variety of lengths, the radiation corresponding to a diapason of sound.

Tyndall found that when a ray of radiant heat was passed through the simple gases, hydrogen, oxygen, nitrogen, &c., substantially no absorption takes place; or, in other words, no increased motion was imparted to the molecules, because their motion was much greater than any of the waves of ether; but when the simple gases were made to combine, the motion of the molecules was lowered to a large extent; and, as a general rule, that the more complex the compound formed, the greater was the reduction of the molecules motion, and the higher was the rate of absorption of a ray of heat sent through the vapours of the complex substance. The following table gives the results of some of Tyndall's experiments on radiant heat at various temperatures:—

Table of the Absorption of Heat by Vapours at a Pressure of 0·5 of an Inch of Mercury.

Name of Vapour.	Formula.	Atoms in Molecules.	Source of Heat: Platinatum Spiral.			
			Barely Visible.	Bright Red.	White Hot.	Near Fusion.
Bisulphide of carbon	CS_2	3	6·5	4·7	2·9	2·5
Chloroform	$CHCl_3$	5	9·1	6·3	5·6	3·9
Iodide of methyl	CH_3I	5	12·5	9·6	7·8	—
Iodide of ethyl	C_2H_5I	8	21·0	17·7	12·8	—
Benzol	C_6H_6	12	26·3	20·6	16·5	—
Amylene	C_5H_{10}	15	35·8	27·5	22·7	—
Sulphuric ether	$C_4H_{10}O$	15	43·4	31·4	25·9	23·7
Formic ether	$C_2H_4O_2$	11	45·2	31·9	25·1	21·3
Acetic ether	$C_4H_8O_2$	14	49·6	34·6	27·2	—

You will observe that as the number of the atoms constituting a molecule become more numerous, the greater is the rate of absorption, except in the case where the atoms of oxygen are introduced, which appears to have a greater power of lowering the rate of motion of the molecules, and consequently heightening the rate of absorption, this being due to the greater complexity of the molecules.

Let us now examine heat transmitted by contact, in which the ether takes no part. If I sound this tuning-fork, and bring it close to the other forks, only one of them, as you are aware, is capable of responding to the moulded pulsations of air sent from the tuning-fork, but if I cause the prongs of the sounding fork to touch any of the other forks, it can cause any of them to sound. If I present the tuning-fork to the strings of the piano, taking care that it does not touch them, only those strings can respond, of which the rate of vibration synchronizes with the waves or pulsations of air passing from the tuning-fork; but if I cause the vibrating prongs to touch the wires, it can set any of them in motion.

In the same way the heated molecules of a substance which radiates ether waves, though quite incapable, through the medium of the ether, of increasing the molecular motion of the molecules of the simple gases, yet when the gaseous molecules are brought into contact with the heated molecules of the substance which radiates the heated wave, the gaseous molecules are at once heated, the clashing molecules striking against each other, communicating the motion to each other in the same way as the moving prongs of our tuning-fork can that of another when they are brought into actual contact.

We have seen that radiant heat has, so to speak, a selective power; that in a mixture of gases and vapours the molecules of the most complex are capable of absorbing the greatest quantity of the ether waves of radiant heat, and the simpler molecules are comparatively inert in the presence of radiant heat.

In the free space above the charge of coal in the retort, the volatile products of distillation are subjected to the action of radiant heat. Those products, as you are aware, are very complex mixtures; some of them, such as the lower members of the olefiant gas, paraffin, and benzole series, which are comparatively simpler bodies, and which are gaseous at ordinary temperatures, it is not desirable to further decompose. These, in consequence of their molecules not having the property of responding to the radiant ether waves radiating from the walls of the heated retort, pass on undecomposed. There are, however, other products of distillation which, if allowed to escape, would condense as tar, and it is therefore desirable to further decompose them, because the products of their decomposition are valuable gaseous illuminants. Now, the radiant heat, although inert, in so far as the simpler compounds are concerned, is not so in the case of those complex compounds, some of which, such as the higher paraffins, contain upwards of fifty atoms in their molecules.

Those complex molecules respond to the ether waves of radiant heat from the walls of the retort, or, so to speak, absorb them; their motion being thereby so accelerated that they are shaken to pieces, or decomposed into simpler compounds. Whereas, when the retort is full charged, and no free space is allowed, the decomposition must be brought about almost entirely by contact between the heated molecules and the molecules of the gases and vapours.

We have seen that when decomposition is so brought about, it is not, so to speak, selective, as when radiant heat is employed decomposing those vapours which it is desirable should be decomposed, and allowing those to escape which it is desirable should not be decomposed; but that all are alike heated and decomposed, and therefore an inferior quality of gas is produced.

I hope that what I have said is sufficient to show how heat, by being differently applied, may bring about very different results; and how it is that the free space left over the charge of coal in the retort leads to better results being obtained.

My next and last note has reference to what may be called condensation or precipitation by impact.

You are all aware that when we have a sudden change from moist warm weather to cold or frosty weather, there is produced by the sudden condensation of the water vapours in the air a dense fog or mist, which is so finely divided that it will continue floating in the air for days. You will also have observed that, in walking through such a mist, the whiskers, so to speak, filter out and entangle those fine particles of moisture, and that hedgerows act in the same way, and keep dripping from the coalescence of the filtered-out particles.

Now, crude coal gases, when suddenly cooled, present much the same conditions as the moist air. The tarry particles and aqueous vapours condense, but in such a finely-divided state as to keep floating forward with the current of gases. This condition of the condensed matter in the crude gases makes it difficult to get them separated, and many plans have been adopted to get quit of them. We have the old breeze-box, in which the particles were filtered out; we have the dry scrubbers filled with coke or brushwood, where the particles were filtered out or entangled, as the fog was filtered from the air by the hedgerows; and lately we have had before us Mr. Aitken's mode of filtering through wire gauze.

I am now desirous of drawing your attention to a mode of separating those particles of condensed matter from the gas. I have here a still containing a little tar and coal, and heated up to the distilling point, by passing through it a current of air or coal gas till it becomes saturated with the vapour, and by cooling it by passing it through this tube the vapour is condensed in the minute state of division I have referred to. The stream of gas containing the finely-divided tarry particles issuing from the pipette is made visible as a jet by the presence of the condensed vapours. Now I may cause that jet to bubble through a considerable depth of water without the tarry matter being separated, and you see they float through the ball. I have here this plate of white porcelain, against which I will now direct the jet of mixed gas and tarry particles. You observe that the tarry particles are at once precipitated, and the gas leaves the plate quite invisible, all the tarry matter being removed. You see how I can go on forming figures with the jet by shifting it about over the plate, the tar being left behind as a black band. Now I wish you to observe that this result is brought about only when the stream or jet is brought within a very short distance of the plate. When I draw the jet a little farther back, the results are not so perfect, and by removing the jet still farther back, the precipitation is altogether arrested.

I shall again repeat the experiment, employing this sheet of glass, which will perhaps enable you to better observe the results. This time I will gradually bring the jet forward to the plate. You will observe that at this distance no precipitation takes place, but gradually, as it approaches closer, the precipitation of the tarry particles becomes more and more perfect, till they are entirely precipitated, and the gas leaves the plate invisible.

So far as I know, there has not hitherto been any scientific explanation published of how those results are brought about. I have given the matter some little thought, and have hit upon what appears to me to be at least a feasible explanation. Whether I am right or wrong in this explanation I shall leave you to decide.

Suppose I take an india-rubber ball, and throw it against a plate, of course it rebounds; but if I take a ball of glazier's putty or of plastic clay, it does not rebound, but either sticks fast to the plate or falls to the ground. Now why does the rubber ball rebound, and why, on the contrary, does the clay stick to the plate? Simply, as you are aware, because the rubber ball is elastic, and the clay not so.

Now it occurred to me that the cause of the precipitation of the finely-divided particles of tar and water from the gas is due to the difference in their elasticity; that when a stream of gaseous molecules and tarry particles is caused to impinge against a plate, the gaseous molecules, being elastic, rebound from the plate, like the rubber ball; whereas the tarry particles, being comparatively non-elastic, do not rebound, but stick to the plate like the plastic clay.

You will remember that, when I made the experiment, I pointed to the fact that it was only when the point of the pipette, from which the mixed gas and tarry particles issued, was brought close to the plate that the precipitation was complete, and that at greater distances the precipitation was not effected. I believe the explanation of those effects to be that, in order to get the minute particles of tar to come into actual contact with the plate, it is necessary that they should be driven forward at a considerable

velocity, because each of the particles of tar is surrounded by an elastic jacket of molecules of the gas which cohere with considerable force; and it is only when the particles of tar are impinged against the plate with such a velocity as to overcome this cohesive force of the molecules of air to the tarry particles, and, as it were, thrust them aside, that the tarry particles come into actual contact with the plate, and are precipitated. Where the velocity is not sufficient to accomplish this, the jacket of elastic air molecules causes the tarry particles to rebound. Further, when the jet is some distance from the plate, the issuing stream of gas and tarry particles entangles the surrounding gas, and in communicating motion to it, is itself partly arrested, and, at the same time, the stream is so enlarged that it meets the molecules of gas recoiling from the plate, and, thereby, the particles of tar are made to rebound, the air molecules acting as an elastic skin.

MM. Pelouze and Audouin, of the Paris Gas-Works, have invented a beautiful arrangement, founded upon the above principle of precipitation, for extracting the condensed finely-divided matter from the gas. As the arrangement has been widely advertised and illustrated, in all probability most of our members are conversant with it. I shall not, therefore, make further allusion to it than to say that, in my opinion, this instrument has not been taken advantage of to the extent it deserves.*

Although this mode of precipitating the tar and other finely-divided condensed matter from the gas is a most beautiful one, there are dangers attending its use; for, if the crude gases are cooled to a low temperature before they are subjected to this precipitating process, there are not only precipitated the tarry and other particles which we wish removed, but also some of the vapours of the volatile hydrocarbons which it is desirable to leave in the gas. Indeed, I believe that this precipitation of the hydrocarbon vapours is one of the causes preventing, to a certain extent, the adoption of this most beautiful invention.

To prevent this injurious effect, it is only necessary to subject the crude gases to the precipitating process whilst they are heated, or to cause the crude gases to impinge against a heated surface.

Now, to obtain the gases in a sufficiently heated state, it would be necessary that they should be heated before they enter the hydraulic main—that is, as the gases would require to be heated as they issue from the stand-pipe, the idea suggested itself to me that this could be advantageously accomplished by substituting the precipitating arrangement for the ordinary hydraulic seal. To produce an automatic seal on the stand-pipe, it is necessary that a certain amount of pressure should be expended in working it, and, by substituting this mode of seal, advantage is taken of the pressure to cause the precipitation of the tarry impurities. It has this further advantage, that it prevents pulsation of the gases inside the retort, with its attendant evils, and the valves being all alike in weight, the pressure inside the retorts can be regulated to be exactly the same. I first tried a modification of the arrangement of MM. Pelouze and Audouin to the stand-pipe; but I found this to be unmanageable, as the small orifices got closed with the sooty tar which was present. However, by substituting a valve arrangement, and, instead of dividing the gas into minute streams, dividing it into sheets or films, and allowing these sheets or films to impinge against a plate, the same end was attained.

The arrangement may partake of a variety of forms; but in its simplest form it very much resembles the ordinary safety-valve for a steam-boiler. I have here a diagram of two forms of arrangement, which are shown as being suitable for attaching to the ordinary stand-pipe in use. The one, you will observe, consists of a mushroom-shaped valve, formed of thin metal, similar to a Morton's self-sealing lid. This valve rests on a turned face, and the valve orifice is surrounded with an annular piece of metal. The crude gases pass up the stand-pipe, and as the valve is more easily lifted than the water of the seal displaced, the crude gases issue in a fine stream or sheet all round the valve, and impinge against the annular plate of metal; the sooty tar particles are precipitated, and flow to the hydraulic, the gases passing, over the surface of the tar in the hydraulic, to the condensing arrangement, by a separate pipe, or to be treated by a succession of such valves, so that the condensed matter may be fractionally precipitated, and the gases left fully charged with the hydrocarbon vapours, which it is desirable should remain in them.

The other arrangement consists of a valve and slotted tube. The valve is lifted by the pressure of the crude gases from the retort, which find their way through the slots. Opposite the slots are ridges of metal, against which the issuing sheet of crude gases impinge, and where the tarry particles are precipitated.

A modification of the latter form of valve may be conveniently employed where it is desirable to treat the crude gases after having been cooled. It consists in making the ridges hollow and introducing steam, which keeps the ridges so hot as to prevent the precipitation of the hydrocarbons from the gases along with the tars, and by employing a series of such precipitations, a very perfect condensation of the gas may be effected.

As the opening and closing of the valves at each charge crushes out or scrapes away any tarry sooty matter which may have collected in the valve orifice or slots, the arrangement is thereby prevented from becoming choked up.

I think, gentlemen, that is a very rough outline of my thoughts on these subjects, which I have jotted down from time to time. As I have already explained, my principal object in bringing them before you to-day was—in so far, at least, as my efforts may avail—to foster among our members the taste for a higher technical education, and with the hope that this narration might induce some of the members, more particularly the younger and more energetic, to take up the subject and experiment for themselves.

Recently, in the pages of the JOURNAL OF GAS LIGHTING, attention has been drawn to the desirability of a higher scientific education among us; and Mr. Nettleton, Secretary of the American Association of Gas Managers, has lately pointed out, in a circular to its members, that it is only by the closest investigation into the natural laws which affect the manufacture of gas—such as chemistry, physics, and applied mechanics—that we shall be able to make such progress in gas manufacture as shall enable us effectually to compete with other forms of lighting.

There can be no question that we shall have a powerful rival in electricity. I have not the least doubt that there is a great future for electric lighting. At present there is no likelihood of its being introduced for domestic purposes, but I can fully believe that the day is not far distant when such improvements shall have been made in the lamp (for there the defect lies) as will enable electricity to be employed for lighting workshops and large open spaces.

The more quickly, therefore, that we put ourselves in fighting position the better; and this, in my opinion, can be done only by bringing to bear upon the subject more energy and a higher scientific training.

Gentlemen, I have to thank you for the kind attention which you have given to these remarks.

The CHAIRMAN: We are indebted to Mr. Young for his interesting paper, which touches on a great variety of subjects, every one of which is of very great importance to those engaged in the manufacture of gas. The deposit of carbon in retorts gives great annoyance, and, besides, is a source of considerable loss. You have heard of the mode of obviating this nuisance. Then we have had information as to the advantages of having a space above the coals in the retorts, and also as to the methods of taking the gas off, as Mr. Young has just stated. If any member would like to have further explanation, I am sure Mr. Young will be glad to answer any questions. [After a pause the CHAIRMAN continued:] If there are no questions to be asked, I would move that a hearty vote of thanks be accorded to Mr. Young for his interesting paper.

Mr. MACLEOD (Glasgow): Would you, Mr. Chairman, allow me to make one suggestion? Within the past month or two, a great deal has been said about the higher education of the gas manager, who, it is insisted, should have a scientific as well as a mechanical training. I think, after the very clear exposition we have had to-day, that the West of Scotland Association might take up the question of establishing a college in Scotland, and appointing Mr. Young to a professor's chair. It is evident that the enemy is at the door, and that men like Mr. Young are required to fight the battle. To revert for a moment to the remarks made by Mr. Young, I must say that I always held the popular idea, although I am not a gas manager, that the whole result of the increased yield arose from the greater surface. Mr. Young has given the scientific idea and the true exposition, and he has given to us simpler people the very good rule of scraping the retorts. No one can find any difficulty in that, and yet, by not attending to it, very serious results will doubtless be produced. I must say, as a non-scientific man, that I was delighted with the paper.

The CHAIRMAN: It is a great misfortune that these improvements are not appreciated as they ought to be. I think, too, besides the education of managers, there is a crying necessity for the education of proprietors, because, whenever there is some slight hitch with new apparatus, the whole invention is pooh-poohed, and there is no hesitation in ordering its removal. I think it would be a great blessing if proprietors of gas-works would appreciate those improvements, and recognize the status of men who devote so much of their time and attention to them. It would be better if we could get them educated up to that point.

The motion was then unanimously agreed to.

(To be continued.)

* This condenser was fully described and illustrated in Vol. XXVIII. of the JOURNAL, No. 703, p. 632.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

With the winter demand for house-fire classes of fuel now springing up, the better descriptions of round coal are moving off more freely, but sellers have still to take very low figures to secure orders. With regard to other descriptions of fuel there is no material change to notice, there being no improvement in the requirements of consumers, whilst some of the inferior classes of fuel are, if anything, worse to sell than ever; the depressed state of the iron trade, and the short time and complete stoppage of work at many of the mills, causing both forge coal and engine fuel to be in very limited request. The quoted prices at the pit mouth remain about as under:—Best house coal, 9s. to 9s. 6d.; seconds, 8s. to 8s. 6d.; Pemberton four-feet, 6s. 6d. to 7s. 6d.; screened gas coal, 6s. 6d. to 7s. 6d.; common coal, 5s. to 6s.; burgy, 4s. to 4s. 6d.; and slack, 3s. to 3s. 6d. per ton. There is, however, so much underselling in the market that quoted prices are anything but reliable as an indication of actual market values, and buyers who are prepared to take large quantities can place their orders at figures which are lower than any that have been known in this district for many years past.

The iron trade still shows no sign of any improvement, and both raw and finished iron are weak in price. Lancashire makers of pig iron, although still quoting 50s. for No. 3 foundry and 49s. for No. 4 forge, less 2½ per cent., delivered into the Manchester district, are willing to sell at 1s. to 1s. 6d. per ton below these figures, and finished iron makers, although quoting about £6 per ton for bars delivered into Manchester, are open to offers for good specifications.

All the works are very short of orders, and matters are in an unsettled state, in consequence of a reduction in wages which is now taking place throughout the district. The men have only just returned to work at several of the large works in the neighbourhood of Manchester after a strike against a reduction of 5 per cent., and now notices are being posted at the works in the Ashton, Dukinfield, Hyde, Hyde Junction, Stalybridge, and Guide Bridge districts of a reduction in wages equal to 7½ per cent. In addition to this an extension of the working hours is also under serious consideration amongst the leading firms in Lancashire.

The annual meeting of the South Lancashire and Cheshire Coal Owners Association was held at Manchester last Tuesday, and Mr. J. H. Johnson, of the Abram Coal Company, near Wigan, was elected President for the ensuing year.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

There were good arrivals of steamers at the coal ports in the early part of last week. Shipments of gas coals went on actively down to Wednesday, when the steamers having cleared out, there was a little more coasting tonnage to go on with, as sailing ships have been kept behind with strong northerly gales for ten days. The weather kept very stormy down to Saturday night, and there was not much prospect then of a change in the wind to enable the ships to reach the port. Under these circumstances coasting freights have advanced considerably; as high as 6s. 6d., and even 6s. 9d., per ton would have been paid ready sailing ships on Saturday to load for London, and 8s. to 8s. 6d. to Poole, with corresponding rates to other ports of the British Channel. There is a considerable quantity of gas coal standing ready to be loaded in vessels at the docks. Steamers will be down again by this time, and take cargoes away; but without there is a change of wind it is impossible for the sailing ships to get out of the bays to reach their ports. The price of gas coal remains about the same. There is not much talk about contracts coming to the market at present, certainly not for any lengthy period. It is anticipated that 6s. per ton for sailing ships, and 5s. for steamers, will continue the figure for carrying coal to London during most of the winter months. There is a better demand for house coal, but nothing corresponding with what might be expected from the state of weather, and what may be called the advent of winter. Prices are very little altered. Large concerns, which ordinarily were very busy at this season, are laying off an outlying colliery or two, to make the output and the demand correspond a little better. Second-class house coals are in abundance, and are sold at low prices. The Northumberland steam coal trade is very much depressed; there is a good prospect, however, that the masters and workmen in this trade will come to an agreement about reduction of wages.

Manufacturing business in the North of England continues in a very dull state. Through the stoppage of a London house, the position of the chemical trade has changed for the worst, and it was bad enough before. All kinds of manufacturing goods are low in price, and difficult to sell. It is evidently going to be a very bad winter for trade in the North of England.

The iron market gives no signs of improvement, but the very contrary. No readjustment of workmen's wages, or even a reduction of railway

charges, are likely to meet the case, and it is quite evident that this will be about the worst winter experienced by the Cleveland iron trade since it became an industry.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Following up the announcement made in last week's "Notes," to the effect that the street-lamps in Dalbeattie were being lighted with oil, it may now be mentioned that a meeting of the Shareholders of the Dalbeattie Gas Company was held last Thursday, for the purpose of considering certain charges which had been made against the Company by Dr. Lewis, the Senior Burgh Commissioner; namely, that the Company had refused to give the Commissioners gas, either by meter, measure, or by arbitration, and that, unless they complied with the alleged exorbitant demand of the Company, the supply would be cut off; which was done. Mr. James Carswell, one of the Directors, having taken the chair, and explained the object of the meeting, the Secretary read over the correspondence which had taken place, on the subject, between the Directors of the Gas Company and the Burgh Commissioners. It amounted to this—that the Commissioners were willing to take the gas by any fair system of measurement, either by meter, or by a class of burner per hour, or by arbitration in accordance with the 129th section of the Police of Towns Act, 1862. The Directors agreed to arbitration, a submission was drawn out, arbitrators were appointed; but, after legal advice had been taken, that offer was withdrawn. The Directors then offered gas at £1 1s. per lamp, which was declined. The Commissioners resolved to burn mineral oil in the street-lamps, and the Company cut off the supply of gas. A long discussion took place, which ended in a vote of thanks being proposed to the Directors of the Company, but no steps were taken to arrange the difference. Immediately afterwards it was proposed that the meeting should hear the Commissioners statement of the matter. Dr. Lewis took the chair, and the whole correspondence was again gone over, with some remarks on the various letters which passed between the two bodies. The result was that a vote of thanks was moved to the Commissioners for the action they had taken in the matter.

The acquisition of the local gas supply undertaking by the Johnstone Police Commissioners is now certain to become a very expensive affair. Not being able to agree upon the appointment of a professional gas engineer as the oversman, the two parties eventually resolved upon having for that post Dr. Anderson Kirkwood, an eminent legal gentleman from Glasgow. Even then it was found impossible to come to an amicable agreement, and, having once let in the legal element, they are now getting an abundance of it. The arbitration was continued during the past week in Glasgow, and a large number of skilled witnesses were examined, and not only was the local legal talent engaged, but it had been deemed advisable to secure in addition the professional services of two eminent advocates from Edinburgh.

On Monday, the 4th inst., the monthly meeting of the Dundee Gas Commissioners was held—Bailie Robertson presiding. Mr. Alexander Maxwell, Convener of the Works Committee, delivered an interesting address, in the course of which he dwelt upon the subject of public lighting by electricity. He paid a marked compliment to Mr. Leng, of the *Dundee Advertiser*, for the experiments which he had made in his offices with the new system of lighting, and he concluded by remarking that, if there was anything to be done in the direction of lighting the town with the electric light, the Gas Commissioners were the parties to take up the matter, as it fell most naturally into their hands. Several other Commissioners spoke on the same subject, and one of them urged that it would be unwise to pay away a great deal of money for extensions of works for a couple of years. On Friday last, the Chamber of Commerce held a meeting for the appointment of five representatives to the Gas Commission. Mr. Maxwell, one of the representatives, again spoke. He said that the gas undertaking was in a very thriving condition. Last year, the rate per 1000 cubic feet was 3s. 8½d., being, he said, lower than anywhere else in Scotland; and the prospects were that next year there might be even a still further reduction. He did not feel alarmed as to the effect of the electric light upon gas-works. Gas, he believed, would still be needed for many places where the electric light could not, in any reason, be available; but that the electric light would trench upon the province of gas he did not doubt. The streets might probably be lighted by it, but that was not a large proportion of their income, and last year they had increased over the previous year as much as the whole outside lighting of the town.

Six £5 shares of the Alyth Gas Company were sold by public auction last Wednesday. They were put up in lots of two shares, the first and second realizing £15 2s. 6d. per lot, and the last was sold at £15 5s.

On Monday last the Glasgow Corporation Nine per Cent. Gas Annuities were sold at £208 10s., as against £210 on the preceding Saturday.

It is stated that the town of Brora, Sutherlandshire, has now a prospect of being supplied shortly with an abundance of good water at moderate rates. The proposal is to take the water from a small loch about three miles distant, the reservoir to be constructed about two miles to the east of the town. It is expected that the charge will not be more than from 6d. to 8d. per pound of rental.

At the last meeting of the Aberdeen Corporation Water Committee a statement of the revenue and expenditure for the year ending the 30th ult. was submitted, showing a considerable balance of income over expenditure; and the probable estimates for the year also showed a favourable balance. After providing for payment of the remaining portion of the debt on the old water-works, it was recommended to reduce the water-rate from 10d. to 8d. per pound of rental, the total reduction since the new water-works were commenced being no less than 7d. per pound.

The Comrie Parochial Board have undertaken a water supply scheme for the village, which will probably cost about £1200.

A civil engineer, who has recently inspected the new water supply of Fort William, states that the supply will be abundant for 30 years to come, and recommends that the loan be spread over that period.

A new water supply, which was completed not very long ago for the town of Fraserburgh, at a cost of about £6000, is already found to be inadequate for the demands of the community in the fishing season, and the Police Commissioners have had the matter under consideration for some time. Various schemes which have been propounded to meet the difficulty now felt have been remitted to Mr. Jenkins, Civil Engineer, Aberdeen, to consider and report.

The Glasgow pig iron market was fairly steady during the week. On Friday the lowest price was 43s. 6½d. cash, and the price at the close in the afternoon was 3½d. per ton lower than on the previous Friday.

There is still a dull and inactive demand for shipping coals, but house descriptions are in somewhat better request.

REDUCTION IN THE PRICE OF GAS AT HEYWOOD.—At the meeting of the Heywood Local Board on Monday, the 28th ult., the recommendation of the Gas Committee, previously referred to in the JOURNAL, to reduce the price of gas to consumers within the Local Board district, by increasing the discount from 9d. to 1s. 3d. per 1000 cubic feet, was agreed to by a large majority.

MARGATE WATER-WORKS COMPANY.—A special meeting of this Company was held on Monday, the 28th ult.—Alderman Pickering in the chair—for the purpose of authorizing the Directors to seek powers whereby they can create new shares or stock to the amount of £7500, and also to borrow the sum of £2500, £2000 of the latter to be capitalized for the purpose of meeting expenses already incurred out of current income. After considerable discussion, as to the position of the new well and mill and as to the driving of adits, in the course of which it was stated that the water supplied by the Company was of the purest quality, a formal motion was unanimously adopted. The Chairman stated that a deputation from the Town Council had waited on the Directors in reference to the proposed purchase of the property for the town; and added, in reply to a Shareholder, that the sum at which the works, &c., were offered was £59,000.

SALFORD CORPORATION GAS SUPPLY.—At the monthly meeting of the Salford Borough Council on Wednesday, the 30th ult., the General Gas Committee reported that at their meeting held on the 2nd of October, the Borough Treasurer submitted a statement of the gas accounts, made up, in consequence of the requirements of the Local Taxation Returns Act, to the 25th of March, and, therefore, being for a period of 8 months and 25 days. The statement, prepared in conformity with the provisions of the Salford Improvement Act, 1862, showed a net clear profit of £7500, to be apportioned between the districts of the borough, in proportion to the gas-rental of the three districts respectively, in accordance with the Act—viz., Salford, £4206 17s. 8d.; Broughton, £1512, 18s. 8d.; Pendleton, £1712 3s. 8d.

WOLVERHAMPTON CORPORATION WATER SUPPLY.—The annual report of the various Committees of the Wolverhampton Town Council were presented at the meeting of that body last Saturday. The Water-Works Committee, for the year ending Sept. 29, report extensions of mains in various parts of the borough; also that 1107 new premises have been laid on, producing an income of £918 per annum. The loss of income by premises being cut off has been £210, leaving a net increase of £717 per annum. The total quantity of water consumed in the entire district has been 742,609,600 gallons, or a daily average of 2,034,546 gallons, of which the township of Bilston consumed 88,528,100 gallons, or a daily average of 242,543 gallons, being 22,543 gallons over the minimum quantity contracted for. During the year the whole of the engines, boilers, and plant have been maintained in a good state of repair and working efficiency.

LORD NORTON AND SANITARY REFORM.—In the course of his opening address at the twenty-second annual congress of the National Association for the Promotion of Social Science, held at Cheltenham on the 23rd ult., Lord Norton briefly dealt with the subject of health, and, referring to recent legislation, remarked that much was still wanted to complete the sanitary reform begun. Areas had to be adjusted, county action provided for, and, above all, consolidation and arrangement of the law. The powers of local authorities on various subjects wanted clearer definition, and, in some respects, widening. In Birmingham, the want of clearness in the law had allowed too wide an exercise of powers given against overcrowded and unhealthy dwellings, so as to embrace grand schemes of town embellishment, involving great town taxation and debt, and town speculation in the property taken in hand for sanitary improvement only. In defence against nuisances, on the other hand, local powers wanted widening. He was especially interested in guarding the supply of water from pollution. His solitary defence of a whole valley from what Birmingham thought to be its natural use as a washpot for the town, had given the precedent for the rural *tuum* against the urban *meum* in this respect. The towns had learnt and taught a great lesson in the struggle—that there was no such thing as refuse to be cast out upon a neighbour or anywhere, but that a real valuable use might be found for everything, if people would take the trouble, or could be forced, to find it out. No more important record could be published than that of things which had been treated as refuse and discovered to be capable of profitable application. The sole remaining problem in arriving at a lucrative application of sewage to land—the only proper application—in the difficult case of large towns, was how to separate storm water from the sewers, admitting only enough of ordinary rainfall to flush them.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

4388.—CHOATE, S. F. VAN, New York, U.S.A., "An improved method of and apparatus for producing electric light, and regulating or controlling and measuring electrical currents for lighting, telegraphing, and other purposes." Oct. 31, 1878.

4403.—BELL, T. A., Liverpool, "Improvements in apparatus for dividing and distributing currents of electricity." Oct. 31, 1878.

4414.—BANCROFT, H., Manchester, "Improvements in sewage carriers and valves." Nov. 1, 1878.

4423.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in pumps or apparatus for raising liquids." A communication. Nov, 1, 1878.

4456.—HIGGINS, F. H. W., Cornhill, London, "Improvements in apparatus for producing, maintaining, and subdividing electric light." Nov. 4, 1878.

4462.—THOMSON, H. L., South Kensington, London, "Improvements in or appertaining to the production of the electric light." Nov. 5, 1878.

4466.—STEWART, C., Islington, London, "Improvements in distributing electricity for the production of electric lights." Nov. 5, 1878.

4473.—GYE, F., Wandsworth Road, London, "Improvements in apparatus for obtaining electric light." Nov. 5, 1878.

4476.—BODMER, G. R., Shepherd's Bush, London, "Improvements in means and apparatus for electric lighting." Nov. 5, 1878.

4502.—BREWER, E. G., Chancery Lane, London, "Improvements in lighting by electricity." A communication. Nov. 7, 1878.

4506.—NAWROCKI, G. W. VON, Berlin, "Improvements in steam-pumps, partly applicable to motor engines and pumps generally." A communication. Nov. 7, 1878.

4514.—WRIGHT, W., Herne Hill, London, "Improvements in valve-apparatus for regulating or controlling the supply and discharge of water or other fluids." Nov. 7, 1878.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1844.—ASHWORTH, G. K., Halifax, Yorks, "Improvements in valves or taps used for steam, water, gas, or other liquid or fluid, such valve or tap being specially applicable for tallow cups for lubricating purposes." May 8, 1878.

2028.—BENNETT, P. D., Birmingham, "Improvements in apparatus employed in the purification of coal gas." May 21, 1878.

2130.—PITT, S., Sutton, Surrey, "Improvements in the manufacture of carbonate of soda by the ammonia process." A communication. May 28, 1878.

3275.—SUTHERLAND, W. S., Birmingham, "Improvements in means and apparatus for moving and compressing gases and fluids." Aug. 20, 1878.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION, and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

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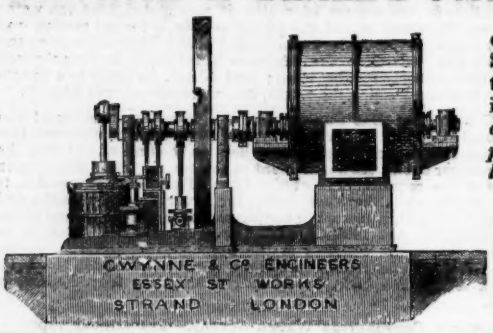

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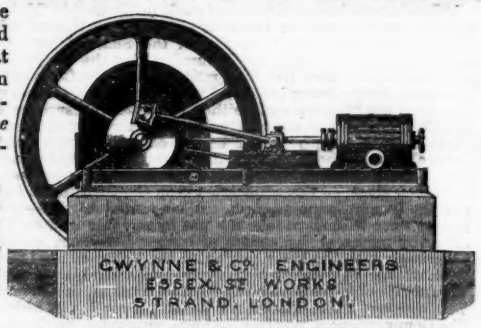

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Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

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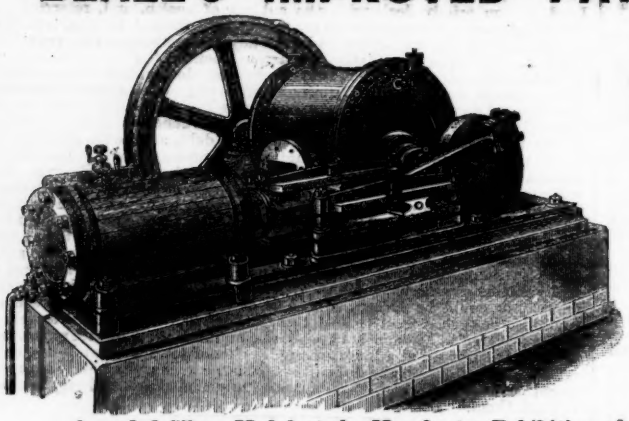

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OFFICES: 115, VICTORIA STREET, WESTMINSTER, S.W.

WANTED, Readers of the Pamphlet, "Cooking and Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Gas-Works, SYDENHAM, S.E.

WANTED, several good Meter Repairers and TINMEN. Wages 30s. per week. None but experienced men of good character need apply.
Application to be made to Mr. H. WOODALL, Gas Office, LEEDS.

WANTED, a Situation as Manager of medium-sized Gas or Water Works, by a person holding the position of Manager and Collector to a Gas and Water Company. Satisfactory reasons for leaving. Good testimonials.
Apply to JOHN CHESTER, Pickering, YORKSHIRE.

INSPECTOR OF WORKS.

WANTED, to Superintend the Erection of a Gasholder and other extensions. Practical experience essential, and a Draughtsman also preferred.
State references and salary required to No. 505, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED immediately, at the Works, a Steady, Respectable MAN. Must understand Gas-Making and Retort-Setting, and be able to read and write. House, gas, and coal found.
Apply to Mr. J. WHITMER, Manager, Gas-Works, NEWPORT PAGNELL.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.
John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

TO GAS MANAGERS AND OTHERS.

A Commission is open, securing a valuable income in every town in the Kingdom.
Apply C 932, *The Times* Office, BLACKFRIARS, E.C.

GASHOLDER FOR SALE.

THE Gas Committee of the Leeds Corporation are prepared to receive OFFERS for a Telescopic GASHOLDER 50 ft. by 24 ft., with Guide Framing and Balance-Weights complete, and in excellent condition.
Further particulars may be had on application to Mr. Woodall, Engineer.
Tenders to be addressed "Chairman, Gas Office," on or before Wednesday, the 20th inst.

TAR AND AMMONIA WATER.

TO BE DISPOSED OF, the Tar and AMMONIA WATER produced at the Merthyr Tydfil Gas-Works.
The Directors of the Company will be glad to receive offers to purchase the same for a period of Three or Five years.
Particulars as to quantity, &c., may be obtained of the undersigned.
The right to accept or refuse the highest or any offer is reserved.
By order,
J. L. COCKER, Secretary and Manager.
Gas Office, Merthyr Tydfil, Glamorganshire,
Nov. 13, 1878.

FOR SALE.—A combined Purifier and CONDENSER, with Centre Change-Valve, suitable for 300 lights.
Apply to the BRYMBO COMPANY, WREXHAM.

LARGE first-class Boring Machine, with Engines and Tackle, FOR SALE, equal to new. Mather and Platt's system.
Apply for particulars to CHARLES TOMLISON, Hadley House, ROTHERHAM.

STATION-METER FOR SALE.

THE Gas Committee of the Rochdale Corporation offer for SALE a STATION-METER, capacity 25,000 cubic feet per hour, 12-in. Connections, Hydraulic Valves, and Bye-Pass, and all other necessary fittings. The Meter to be removed in consequence of extensions.
Any further information thereon can be had from the Manager at the Works.
Tenders, endorsed "Tender for Station-Meter," must be sent to me on or before the 13th inst.
By order,
ZACH. MELLOR, Town Clerk.
Town Hall, Rochdale, Aug. 2, 1878.

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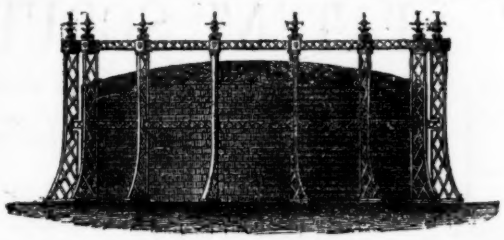

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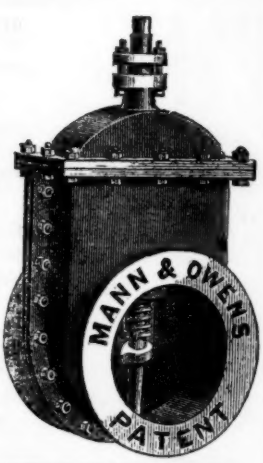

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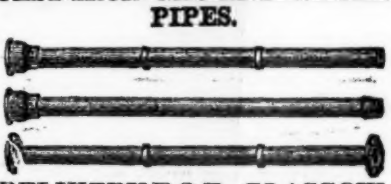

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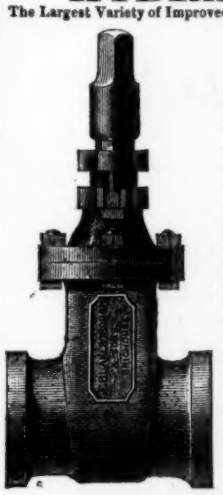

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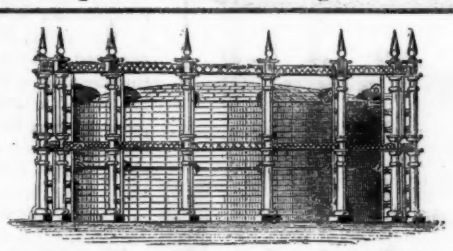

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POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

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Established 1840.

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The Owners of the Dean's Primrose Colliery.

Dear Sirs,—I have much pleasure in stating that this Company have regularly used your Coals for more than thirty years, and that in all essential particulars they give the most satisfactory results.

The yield of Gas is from 9700 to 9800 feet per ton, of full 16 candles illuminating power, tested by the London Referees Standard Burner; and the Coke is of very good quality, while the quantity is about 40 bushels to the ton of Coal.

I consider Dean's Primrose Coals to rank amongst the first-class Gas Coals from the Durham Coal-Field.

Yours truly, GEORGE LIVESEY.

These Coals are also used by The Gaslight and Coke Company (London), and other English and Foreign Gas Companies.

Steamers loaded with quick despatch in the River Tyne. Price and other terms on application at the

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The Coke is of excellent quality, and in quantity amounts to about 40 bushels from a ton of Coal.

The annual consumption of Coal amounts to about 75,000 tons.

GEORGE LIVESEY, Engineer and Secretary.

P.S.—I am at this date, Feb. 15, 1875, still using Holmside Coals as largely as ever, and am quite as well pleased with them as when I gave the above certificate.

GEORGE LIVESEY.

We have this year, 1878, using 80,000 tons of Holmside Coal. GEORGE LIVESEY.

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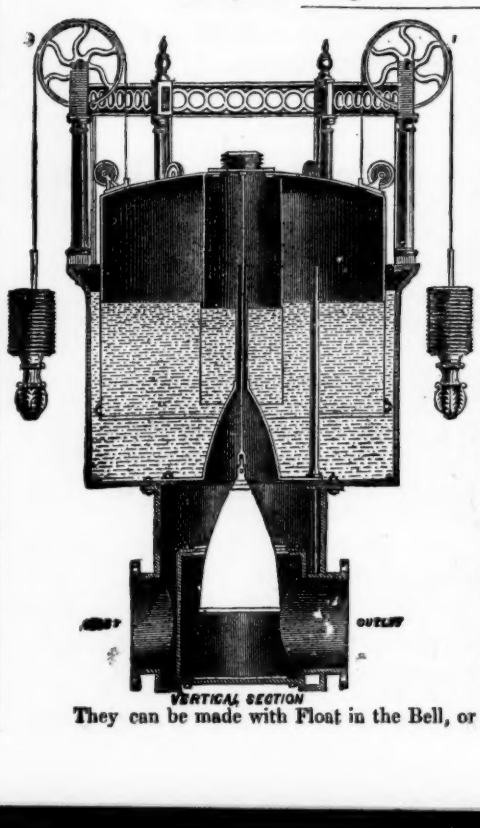

VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

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The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

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A recent extensive development of the Collieries enables us to offer increased supplies.

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"*Warrington Gaslight and Coke Company, Offices, Mersey Street, Warrington, April 23, 1877.*

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

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The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

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Sixteen recently erected at Beckton, applied to Covers 30 feet square.

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